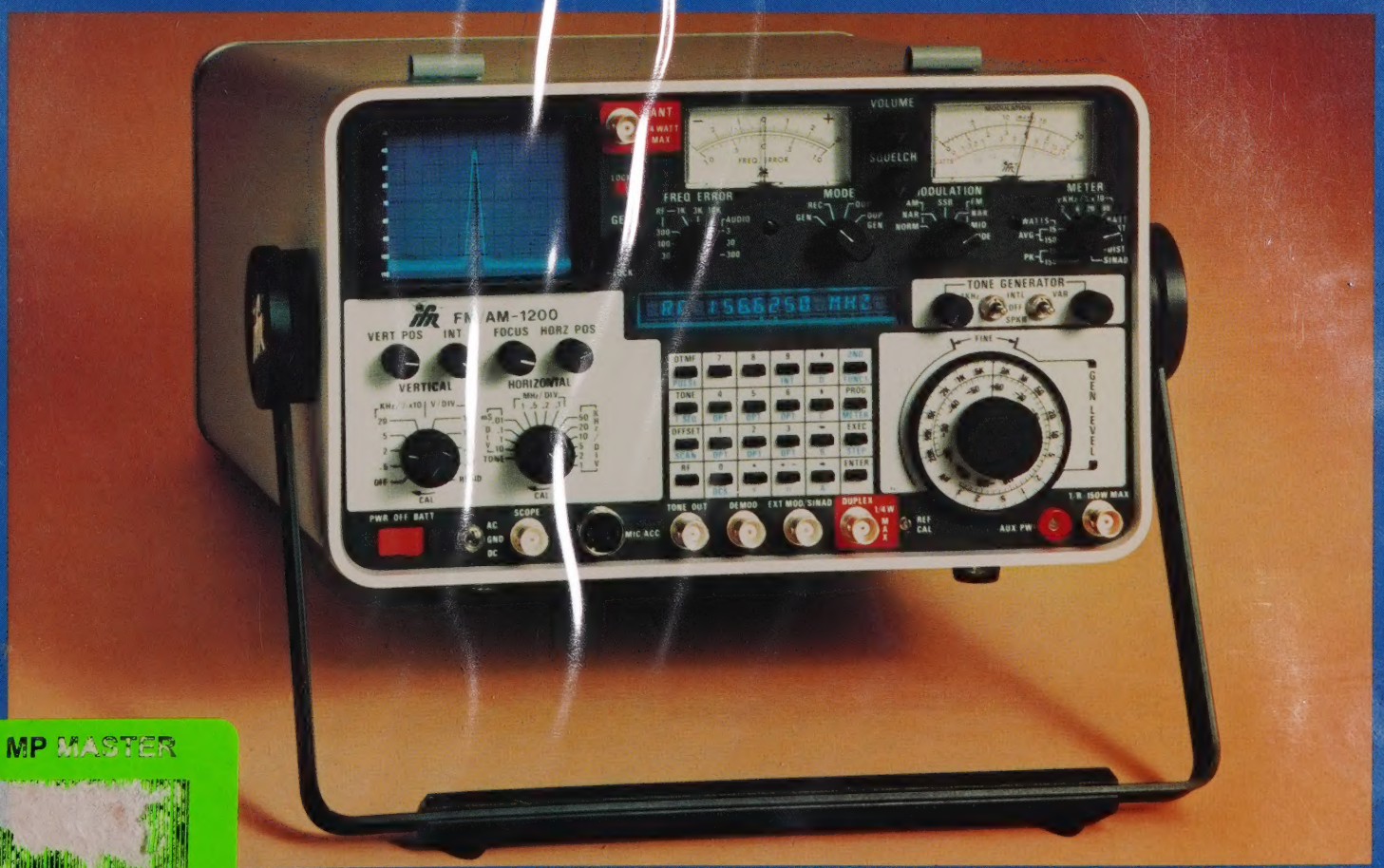
# OPERATION MANUAL

# FM/AM-1200

## COMMUNICATIONS SERVICE MONITOR




MP MASTER
MA30508

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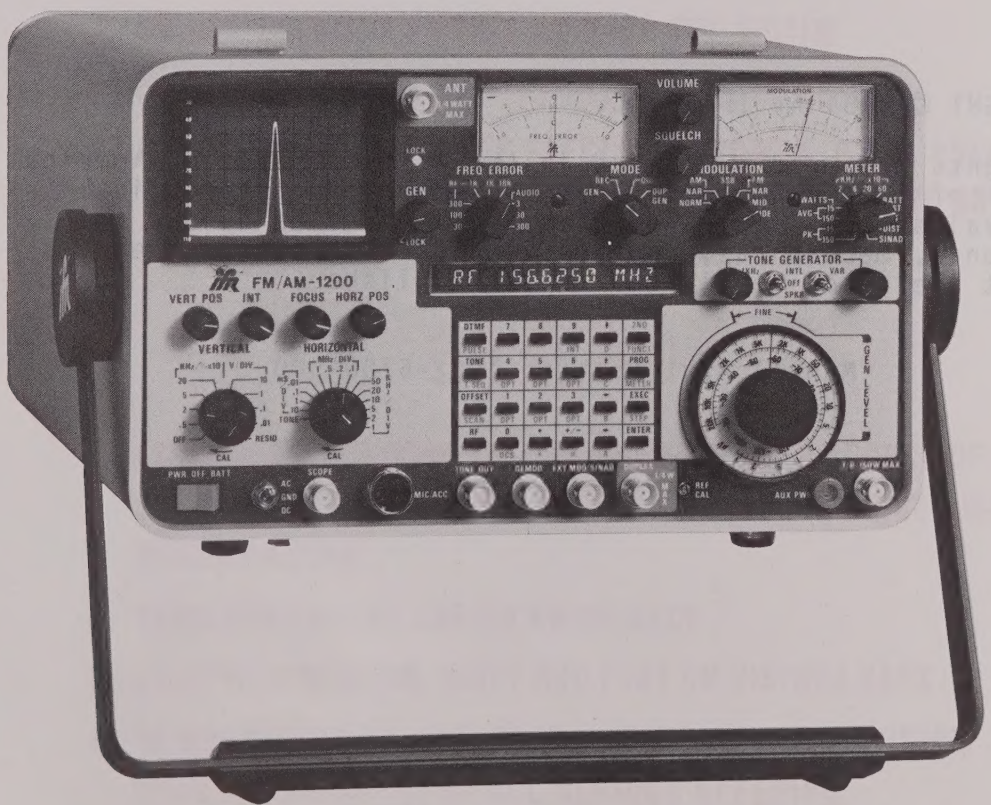


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Manual Part Number: 1002-5100-500

# WARNING:

## HIGH VOLTAGE EQUIPMENT

THIS EQUIPMENT CONTAINS CERTAIN CIRCUITS AND/OR COMPONENTS OF EXTREMELY HIGH VOLTAGE POTENTIALS, CAPABLE OF CAUSING SERIOUS BODILY INJURY OR DEATH. WHEN PERFORMING ANY OF THE PROCEDURES CONTAINED IN THIS MANUAL, HEED ALL APPLICABLE SAFETY PRECAUTIONS.

## RESCUE OF SHOCK VICTIMS

1. DO NOT ATTEMPT TO PULL OR GRAB THE VICTIM
2. IF POSSIBLE, TURN OFF THE ELECTRICAL POWER.
3. IF YOU CANNOT TURN OFF ELECTRICAL POWER, PUSH, PULL OR LIFT THE VICTIM TO SAFETY USING A WOODEN POLE, A ROPE OR SOME OTHER DRY INSULATING MATERIAL.

## FIRST AID

1. AS SOON AS VICTIM IS FREE OF CONTACT WITH SOURCE OF ELECTRICAL SHOCK, MOVE VICTIM A SHORT DISTANCE AWAY FROM SHOCK HAZARD.
2. SEND FOR DOCTOR AND/OR AMBULANCE.
3. KEEP VICTIM WARM, QUIET AND FLAT ON HIS/HER BACK.
4. IF BREATHING HAS STOPPED , ADMINISTER ARTIFICIAL RESUSCITATION. STOP ALL SERIOUS BLEEDING.

**CAUTION**

INTEGRATED CIRCUITS AND SOLID STATE DEVICES SUCH AS MOS FET'S, ESPECIALLY CMOS TYPES, ARE SUSCEPTIBLE TO DAMAGE BY ELECTROSTATIC DISCHARGES RECEIVED FROM IMPROPER HANDLING, THE USE OF UNGROUNDED TOOLS, AND IMPROPER STORAGE AND PACKAGING. ANY MAINTENANCE TO THIS UNIT MUST BE PERFORMED WITH THE FOLLOWING PRECAUTIONS:

1. BEFORE USING IN A CIRCUIT, KEEP ALL LEADS SHORTED TOGETHER EITHER BY THE USE OF VENDOR-SUPPLIED SHORTING SPRINGS OR BY INSERTING LEADS INTO A CONDUCTIVE MATERIAL.

2. WHEN REMOVING DEVICES FROM THEIR CONTAINERS, GROUND THE HAND BEING USED WITH A CONDUCTIVE WRISTBAND.

3. TIPS OF SOLDERING IRONS AND/OR ANY TOOLS USED MUST BE GROUNDED.

4. DEVICES MUST NEVER BE INSERTED INTO NOR REMOVED FROM CIRCUITS WITH POWER ON.

5. PC BOARD, WHEN TAKEN OUT OF THE SET, MUST BE LAID ON A GROUNDED CONDUCTIVE MAT OR STORED IN A CONDUCTIVE STORAGE BAG.

**NOTE**

Remove any built-in power source, such as a battery, before laying PC Boards on conductive mat or storing in conductive bag.

6. PC BOARDS, IF BEING SHIPPED TO THE FACTORY FOR REPAIR, MUST BE PACKAGED IN A CONDUCTIVE BAG AND PLACED IN A WELL-CUSHIONED SHIPPING BOX.

THE USE OF SIGNAL GENERATORS FOR MAINTENANCE AND OTHER ACTIVITIES CAN BE A SOURCE OF ELECTROMAGNETIC INTERFERENCE TO COMMUNICATION RECEIVERS, WHICH CAN CAUSE DISRUPTION AND INTERFERENCE TO COMMUNICATION SERVICE OUT TO A DISTANCE OF SEVERAL MILES.

USERS OF THIS EQUIPMENT SHOULD SCRUTINIZE ANY OPERATION WHICH RESULTS IN RADIATION OF A SIGNAL (DIRECTLY OR INDIRECTLY) AND SHOULD TAKE NECESSARY PRECAUTIONS TO AVOID POTENTIAL COMMUNICATION INTERFERENCE PROBLEMS.

# LIST OF EFFECTIVE PAGES

The manual pages listed below which are affected by a current change or revision, are so identified by a revision number and an asterisk.

Date of issue for original and changed pages are:

Original ..... 0 ..... December 1, 1984

TOTAL NUMBER OF PAGES IN THIS MANUAL IS 110 CONSISTING OF FOLLOWING:

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| Warning Page | 0 |
| Caution Page | 0 |
| A | 0 |
| B Blank | 0 |
| i thru viii | 0 |
| 1-1 thru 1-3 | 0 |
| 1-4 Blank | 0 |
| 2-1 thru 2-6 | 0 |
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| 3-14 Blank | 0 |
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| 5-1 thru 5-4 | 0 |
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# PREFACE

## SCOPE

This manual contains instructions for operating the FM/AM-1200 Communications Service Monitor. The instruction level of this manual is relatively basic and presupposes no previous experience on the part of the operator with a communication service monitor of this type. A basic understanding, however, of communication electronics and practical troubleshooting methods will be helpful. It is strongly recommended that operator be thoroughly familiar with Sections 1 through 3 of this manual before attempting to perform any operating procedures contained in Section 4.

## ORGANIZATION

The operation manual is divided into the following major sections:

SECTION 1 - INTRODUCTION
Provides a brief introduction to the FM/AM-1200 including purpose, functional capabilities and uses.

SECTION 2 - INSTALLATION
Provides a step by step procedure for setting up the FM/AM-1200 for operation.

SECTION 3 - DESCRIPTION OF CONTROLS, CONNECTORS & INDICATORS
Identifies and functionally describes all FM/AM-1200 controls, connectors and indicators.

**NOTE**

As an operating aid, Figure 3-1 (which locates and identifies all FM/AM-1200 front panel controls) has been incorporated into a fold-out page. By extending the fold-out page, the operator can easily reference any front panel control while simultaneously performing any operating procedure contained elsewhere in this manual.

SECTION 4 - OPERATION
Contains instructions for operating the FM/AM-1200 Keyboard and VFD. Using the Keyboard, the operator can enter data into the FM/AM-1200 in the following modes:

1. Direct Data Entry
2. Programmed Data Entry into Memory
3. Executed Data Entry from Memory

In addition to Keyboard operation, this section contains a selection of basic operating procedures pertaining to all major functions of the FM/AM-1200.

SECTION 5 - MINIMUM PERFORMANCE CHECK
Contains a quick, qualitative, step-by-step check for assessing the performance of the FM/AM-1200.

Useful supplementary information relating to the operation of the FM/AM-1200 is contained in appendices at rear of manual. (See Table of Contents for detailed list of manual contents.)

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# SECTION 1 - INTRODUCTION

## 1-1 GENERAL

The FM/AM-1200 is a microprocessor controlled, digitally synthesized communication service monitor, which integrates the functions of several different test instruments into a single, compact and portable unit. Utilizing such features as a keyboard entry system, a Vacuum Fluorescent Display for digital readout, processor controlled memory functions and a CRT capable of displaying oscilloscope or spectrum analyzer inputs, the FM/AM-1200 incorporates the functions of the following test equipment:

1. Signal Generator
2. Communication Receiver
3. Spectrum Analyzer
4. Oscilloscope
5. 1 kHz (Fixed) Tone Generator
6. Variable Tone Generator (Programmable)
7. Power Meter
8. Frequency Error Meter
9. Modulation Meter
10. SINAD Meter
11. Audio Error Meter
12. Signal Strength Meter
13. DUPLEX Generator (with a selectable offset)

These capabilities enable the FM/AM-1200 to be used in a wide range of communication test functions associated with most types of simplex and duplex transceiving equipment, including mobile telephone systems, AM/FM/SSB transceivers, CB and two-way radio systems, repeaters, etc.

## 1-2 SIGNAL GENERATOR/RECEIVER

The FM/AM-1200 Signal Generator is capable of generating modulated or unmodulated carrier signals within a range of 250 kHz to 999.9999 MHz (in 100 Hz steps), at an output level which is continuously variable from -20 to -128 dBm. The generated carrier signal may be AM or FM modulated by internal modulation signals from the FM/AM-1200 tone generators or by external sources applied through front panel modulation input connectors defined in Section 3 of this manual. The signal generator may also be voice-modulated and keyed through the front panel microphone input connector. All of the above described modulation sources, or any combination thereof, may be simultaneously applied to the carrier signal. During signal generator operation, signals being generated can be monitored by the FM/AM-1200 receiver and its associated monitoring devices.

The signal generator also features a selectable offset frequency function to permit testing of duplex equipment, which receives and transmits simultaneously on different frequencies. See paragraph 1-3 for additional information about this feature.

The FM/AM-1200 receiver is a triple conversion, superheterodyne receiver, capable of monitoring communication signals within a range of

250 kHz to 999.9999 MHz, in 100 Hz steps. Signals may be received "off-the-air" using an external antenna or by direct cable connection through the front panel T/R Connector. Associated receiver monitoring circuits include a frequency error meter, modulation meter, power meter, SINAD meter, signal strength meter, frequency error and demodulated audio counters, spectrum analyzer and oscilloscope.

## 1-3 FM/AM-1200 CAPABILITIES

A prime feature of the FM/AM-1200 is the capability of testing both simplex and duplex communication equipment. Simplex operation is defined as any equipment that communicates in only one direction at a time on the same frequency, including ordinary transmit-receive or press-to-talk operation, voice operated carrier and other forms of manual or automatic switching from transmit to receive. Duplex operation is characteristic of any equipment which transmits on one frequency and receives on another frequency between two locations, such as mobile telephone systems and repeaters.

In receive, the FM/AM-1200 receiver monitors incoming signals received "off-the-air" or applied via direct cable connection through the front panel T/R Connector. In this mode, the FM/AM-1200 signal generator is inactive. In the generate mode, the FM/AM-1200 is capable of generating modulated or unmodulated carrier signals while the receiver circuits are simultaneously monitoring the generator.

In the duplex mode, the FM/AM-1200 has the capability of generating and receiving signals simultaneously. While the receiver section of the FM/AM1200 is monitoring incoming signals transmitted by the UUT, the FM/AM-1200 duplex generator is simultaneously generating signals to stimulate the receiver section of the UUT. The frequency of the generated signal from the FM/AM-1200 can be offset up to ±49.99 MHz from the receiving frequency in 10 kHz steps. Three methods of duplex testing are available using the FM/AM-1200. They are:

1. Duplex Testing using separate Transmit/Receive Lines
2. Duplex Testing using one common Transmit/Receive Line
3. "Off-the-air" Duplex testing

The methods of duplex testing are described in detail in Section 4.

## 1-4 DATA DISPLAY AND CONTROL FEATURES

Operator interaction with the FM/AM-1200 is facilitated through the following primary data display and control features:

1. KEYBOARD
   The Keyboard provides a means of entering data into the FM/AM-1200 microprocessor, to control the operation of the RF Frequency or Tone Generator functions. The Keyboard is also used to address the FM/AM-1200 programmable functions which utilize the automatic storage, retrieval and execution capabilities of the set. All Keyboard functions are described in detail in Section 3.

2. VFD
   The Vacuum Fluorescent Display (VFD) is used to display the current Keyboard operating frequencies associated with the FM/AM-1200 tone generator or RF Frequency functions. The VFD will display any telephone number selected during DTMF or PULSE functions (Ref. Section 3) as well as provide a digital readout of the selected range of both the FREQ ERROR and MODULATION Meters.

## 1-5 GENERATOR/RECEIVER SUPPORT FUNCTIONS

The FM/AM-1200 has the following additional operating functions which are primarily used to support the generate/receive capabilities of the set:

| | |
|---|---|
| Spectrum Analyzer | Fixed Tone Generator |
| Oscilloscope | Programmable Tone Generator |
| Modulation Meters | Freq Error Meter |

The application and use of these functions are described in detail in Sections 3 and 4.

# SECTION 2 - INSTALLATION

## 2-1 GENERAL

Preparing the FM/AM-1200 for operation is a simple procedure which consists of the following basic steps (Ref. Figures 2-1 and 2-2):

**CAUTION**

ANT CONNECTOR (34) IS USED FOR "OFF-THE-AIR" TESTING AND WITH OPTIONAL GENERATE AMPLIFIER ONLY. DO NOT CONNECT A TRANSMITTER TO THIS INPUT.

DO NOT CONNECT UUT TRANSMITTER OUTPUT TO ANY JACK OTHER THAN T/R CONNECTOR (11).

MAXIMUM "ON" TIME FOR MEASUREMENT OF UUT TRANSMITTER OUTPUT USING T/R CONNECTOR (11) IS:

150 W = 1 MINUTE "ON", 5 MINUTES "OFF".
↓
100 W = 1½ MINUTES "ON", 4 MINUTES "OFF".
↓
75 W = 2 MINUTES "ON", 2 MINUTES "OFF".
↓
50 W = MAXIMUM CONTINUOUS

IF THE FM/AM-1200 IS PLUGGED INTO A VEHICLE'S DC SUPPLY, DISCONNECT THE SET WHILE STARTING THE ENGINE.

REMOVE ANY POSSIBLE STATIC CHARGE FROM AN UNTERMINATED ANTENNA BEFORE CONNECTING TO THE FM/AM-1200 ANT CONNECTOR (34). THE T/R CONNECTOR (11) MAY BE USED FOR THIS PURPOSE.

DO NOT FORCE RF LEVEL CONTROLS (9) AND (10) PAST THE STOPS.

1. Set FM/AM-1200 into a vertical or horizontal operation position, with lid removed.

2. Connect external antenna to FM/AM-1200 ANTENNA Connector, if "off-the-air" monitoring is desired.

3. Apply electrical power to FM/AM-1200 as follows:

**CAUTION**

THE FM/AM-1200 IS SHIPPED FROM FACTORY WITH THE AC POWER SELECT SWITCH IN THE 115 VAC POSITION. DO NOT APPLY EXTERNAL POWER ABOVE 115 VAC UNLESS SWITCH IS POSITIONED TO 230 V (REF. FIG. 2-3) (REF. APPENDIX A, SPECIFICATION A-14).

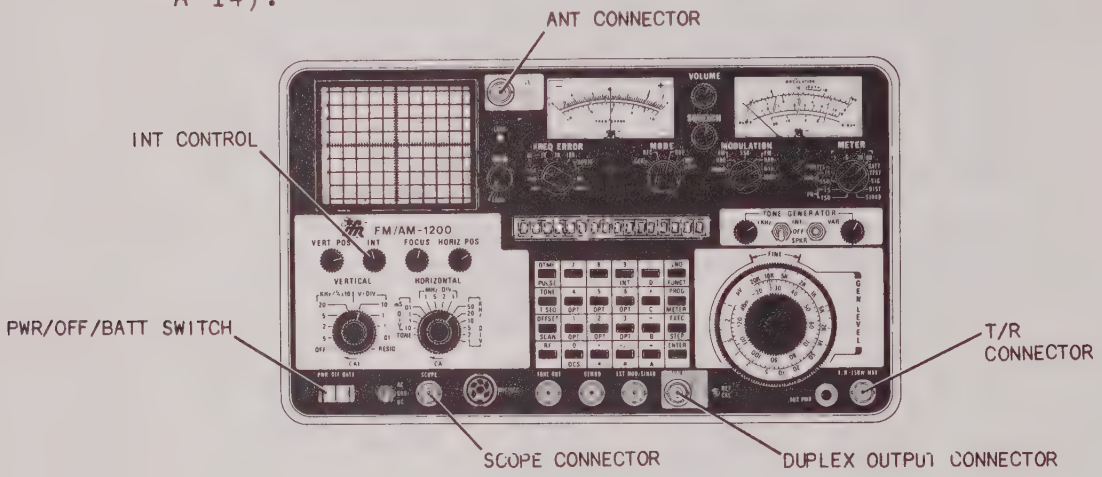



Figure 2-1 FM/AM-1200 Front Panel

EXTERNAL AC Power

1. Connect furnished AC power cable between 115/230 VAC power source and AC Power Input Connector on rear panel of FM/AM-1200.

2. Place PWR/OFF/BATT Switch to "PWR" position.

EXTERNAL DC Power

1. Connect supplied DC Power Cable between external 12 to 30 VDC power source and DC Power Input Connector on rear panel of FM/AM-1200.

2. Place PWR/OFF/BATT Switch to "PWR" position.

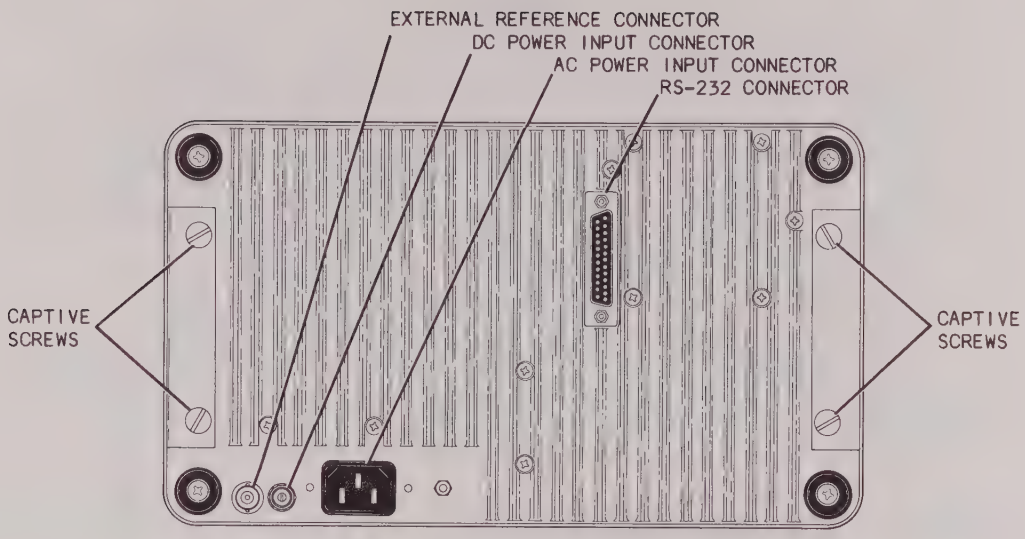



Figure 2-2 FM/AM-1200 Rear Panel

INTERNAL Battery Operation:

1. Place PWR/OFF/BATT Switch to "BATT" position, if optional battery is installed. (This is a Spring-Loaded ON/OFF Switch.) When operating the test set on battery, an internal timer will interrupt power after approximately 10 minutes. Depress PWR/OFF/BATT Switch to "BATT" position to restore power to test set.

**NOTE**

The internal battery is charged whenever the test set is connected to external AC or DC power, regardless of whether the PWR/OFF/BATT Switch (22) is in either the "ON" or "OFF" position. Typical recharge time is 12 hours for a full charge. Minimum external DC input required for full charge is 15 VDC.

**NOTE**

The oven oscillator (Option 02 only) is powered by the internal battery when the test set is switched to battery operation. In the battery mode, there is no provision for preheating the oven oscillator. A 15 minute warm-up period is required, with the test set at room temperature, in order to stabilize the oven oscillator. However, the FM/AM-1200 will turn on and operate immediately in the battery mode, but the oven oscillator frequency will not be within specifications without the required 15 minute warm-up period. It is therefore recommended that the FM/AM-1200 be connected to an external AC or DC power source for the required 15 minute warm-up period.

## 2-2 GENERAL OPERATING DATA

The FM/AM-1200 Communications Service Monitor is shipped with the AC Power Select Switch (Ref. Figure 2-3) positioned to "115 VAC". If it is necessary to operate FM/AM-1200 using 220 VAC, the AC Power Select Switch must be positioned to "230 VAC" prior to the application of electrical power. The procedure to reposition this switch is as follows:

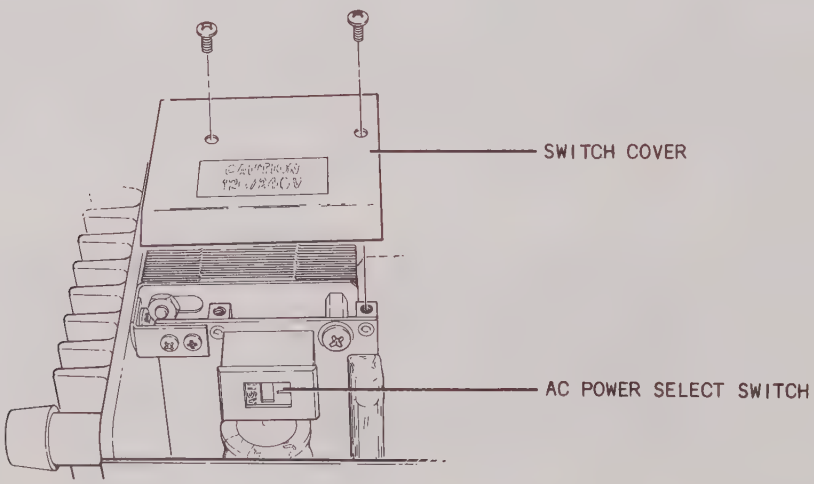



Figure 2-3 AC Power Select Switch Location

| STEP | PROCEDURE |
|---|---|
| | CASE REMOVAL |
| 1. | Loosen four captive screws attaching rear escutcheon to Rear Panel Heat Sink (Ref. Figure 2-2). |
| 2. | Remove escutcheon, then slide case from chassis. |
| | AC POWER SELECT SWITCH POSITIONING |
| 3. | Remove two screws from Switch Cover Plate (with CAUTION placard) to expose AC Power Select Switch (Ref. Figure 2-3). |
| 4. | Verify position of switch and, if necessary, slide switch indicator until desired power rating is visible (Ref. Figure 2-3). |
| 5. | Re-install Cover Plate (Ref. Figure 2-3). |
| | CASE INSTALLATION |
| 6. | Slide case over chassis and engage case in groove of front escutcheon. Position rear escutcheon on case. Engage case in groove of rear escutcheon and tighten four captive screws securing rear escutcheon to Rear Panel Heat Sink. |

## 2-3 INSTALLATION AND OPERATING PRECAUTIONS

To prevent possible damage to FM/AM-1200, the following power input and general operating precautions should be observed at all times (Ref. Figure 2-1 for connector locations):

**CAUTION**

ANTENNA CONNECTOR
DO NOT TRANSMIT INTO THIS CONNECTOR. MAXIMUM INPUT INTO THIS CONNECTOR MUST NOT EXCEED 0.25 WATT, OR DAMAGE TO FM/AM-1200 WILL RESULT.

T/R CONNECTOR
MAXIMUM CONTINUOUS INPUT TO T/R CONNECTOR IS 50 WATTS.

DUPLEX OUTPUT CONNECTOR
DO NOT TRANSMIT INTO THIS CONNECTOR. THIS CONNECTOR IS NOT PROTECTED FOR POWER INPUTS IN EXCESS OF 0.25 WATT.

CRT INTENSITY
DO NOT OPERATE CRT DISPLAY WITH EXCESSIVE INTENSITY.

SCOPE CONNECTOR
DO NOT APPLY MORE THAN 200 VOLTS PEAK TO PEAK TO THIS CONNECTOR.

PWR/OFF/BATT SWITCH
TO PROVIDE MAXIMUM PROTECTION OF NON-VOLATILE MEMORY CONTENTS, OBSERVE THE FOLLOWING STEPS:

1. Allow a minimum of one second between selection of "PWR" and "OFF" positions. Do not rapidly cycle power on and off.

Do not apply any signals into the FM/AM-1200 other than those defined in the operating instructions. Other than the input power and operating restrictions described above, any combination of front panel control positions will not adversely affect the FM/AM-1200.

## 2-4 EXTERNAL POWER INTERRUPTION PROTECTION

The FM/AM-1200 incorporates an external power interruption protection circuit, in case the external AC power is unexpectedly lost during FM/AM-1200 use. After power is lost, approximately 15 seconds of power will be available to complete or terminate a function. This system is only operational with optional battery installed.

## SECTION 3 — DESCRIPTION OF CONTROLS, CONNECTORS & INDICATOR

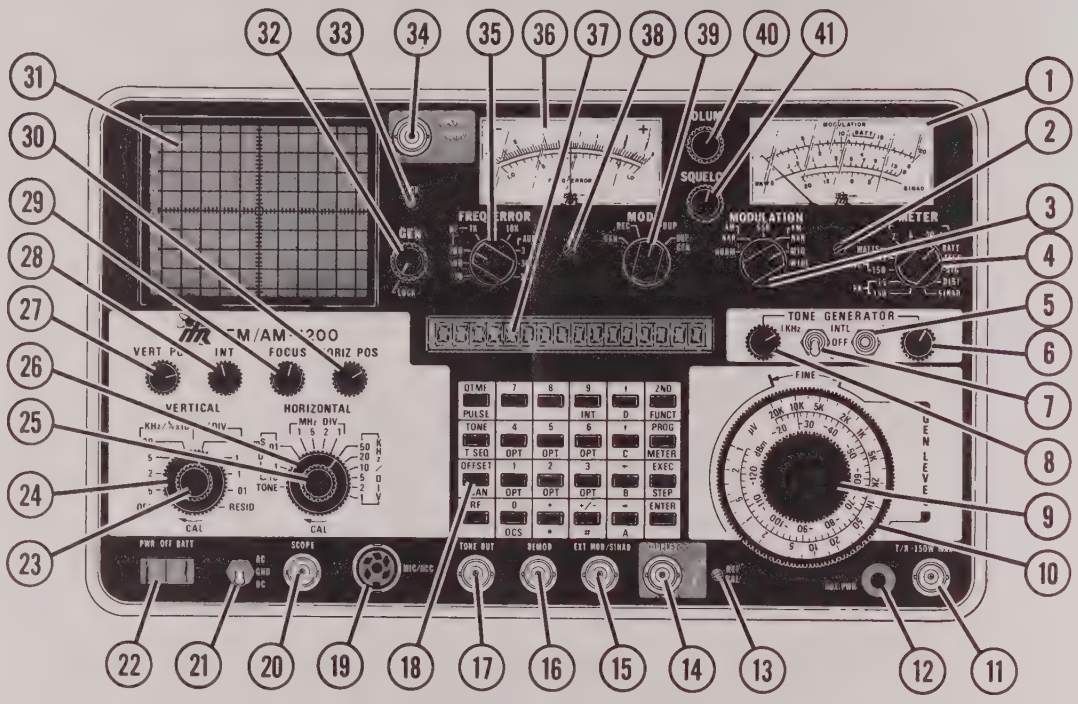



Figure 3-1 FM/AM-1200 Front Panel Controls, Connectors & Indicators

1. MODULATION METER
2. Modulation Meter Zero Adjustment
3. MODULATION Select Control
4. Modulation METER Control
5. VAR Tone Selector Switch
6. VAR Tone Level Control
7. 1 kHz Tone Selector Switch
8. 1 kHz Tone Level Control
9. RF Level Attenuator Control
10. RF Level Attenuator Vernier Control
11. T/R Connector
12. AUX POWER Connector (Option 05 Gen. Amp only)
13. REF CAL Adjustment
14. DUPLEX Output Connector
15. EXT MOD/SINAD Connector
16. DEMOD Connector
17. TONE OUT Connector
18. Keyboard
19. MIC/ACC Connector
20. SCOPE Connector
21. AC/GND/DC Switch (Scope)
22. PWR/OFF/BATT Switch
23. Scope VERTICAL Attenuator Vernier Control
24. VERTICAL Attenuator Selector Control
25. Scope HORIZONTAL Sweep Vernier Control
26. HORIZONTAL Sweep Selector Control
27. VERT POS Control
28. INT Control
29. FOCUS Control
30. HORIZ POS Control
31. CRT Display
32. GEN/LOCK Control
33. LOCK Lamp
34. ANT Connector
35. FREQ ERROR Meter Range Selecto Control
36. FREQ ERROR Meter
37. VFD (Vacuum Fluorescent Displa
38. FREQ ERROR Meter Zero Adjustme
39. MODE Selector Control
40. VOLUME Control
41. SQUELCH Control

## FM/AM-1200 FRONT PANEL

M NAME DESCRIPTION

. MODULATION Meter
Provides a visual display of modulation levels, RF power levels (peak and average), relative signal strength, battery test voltage, distortion and SINAD when selected by MODULATION Meter Control (4). (See Figure 3-2.)

. Modulation Meter Zero Adjustment
Adjustment screw for mechanical zeroing of MODULATION Meter (1) when power to FM/AM-1200 is "OFF".

. MODULATION Select Control
Selects modulation and demodulation modes of FM/AM-1200 receiver for for FM, AM, SSB and their associated pre- and post-detection bandwidths as shown in Table 3-1.

| MODULATION SELECT CONTROL POSITION | DEMODULATION MODE | PRE-DETECTION BANDWIDTH | POST-DETECTION BANDWIDTH |
|---|---|---|---|
| AM | | | |
| NAR | AM | 6 kHz | 8 kHz |
| NORM | AM | 15 kHz | 8 kHz |
| SSB | SSB | 6 kHz | 8 kHz |
| FM | | | |
| NAR | FM | 15 kHz | 8 kHz |
| MID | FM | 200 kHz | 8 kHz |
| WIDE | FM | 200 kHz | 80 kHz |

Table 3-1 Modulation Select Control Positions

. Modulation METER Control
Selects input source for MODULATION Meter (1) as shown in Table 3-2 (Reference Figure 3-2).

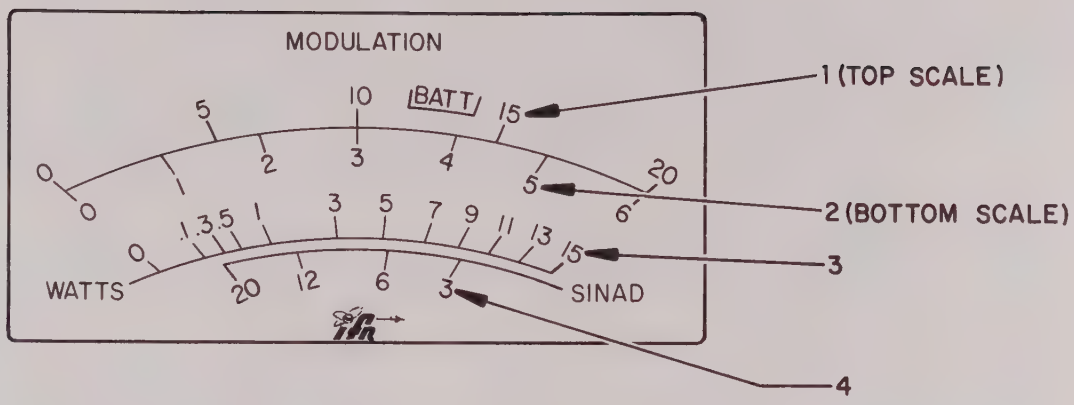



Figure 3-2 Modulation Meter Scales

| MODULATION METER CONTROL POSITION | INPUT SOURCE | MODULATION METER RANGE | MODULATION METER SCALE (Ref. Fig. 3-2) |
|---|---|---|---|
| WATTS<br>AVG 15<br>AVG 150<br>PK 15<br>PK 150 | T/R CONNECTOR | 15 WATTS (full scale) to 150 watts (full scale) | 3 |
| kHz/% X 10 (All Positions) | FM/AM-1200 Demodulator | 2 kHz DEV/20% AM (full scale) to 60 kHz DEV/600% AM (full scale) | 1 & 2 |
| BATT TEST | Internal Battery | 0 to 20 VDC | 1 |
| SIG | ANTenna Connector | Relative signal strength (not calibrated) | None; observe relative deflection of meter needle |
| DIST | EXT MOD/SINAD Connector | 0% to 20% | 1 |
| SINAD | EXT MOD/SINAD Connector | 3 dB to 20 dB | 4 |

Table 3-2 Modulation Meter Control Positions

| ITEM | NAME | DESCRIPTION |
|---|---|---|

5. VAR Tone Selector Switch
Selects variable tone as follows:

"INTL" - Internal modulation of generator output, and TONE OUT Connector (17). TONE OUT Connector (17) and HORIZONTAL Sweep Selector Control (26) in TONE Position.

"OFF" - Disconnects tone from internal modulation, TONE OUT Connector (17), HORIZONTAL Sweep Selector Control (26) and Speaker.

"SPKR" - Variable tone will be routed to the FM/AM-1200 Speaker only.

6. VAR Tone Level Control
Controls variable tone level.

7. 1 kHz Selector Switch
Selects 1 kHz fixed tone as follows:

"INTL" - Internal modulation of generator output and TONE OUT Connector (17). TONE OUT Connector (17) and HORIZONTAL Sweep Selector Control (26) in TONE Position.

"OFF" - Disconnects tone from internal modulation, TONE OUT Connector (17), HORIZONTAL Sweep Selector Control (26) and Speaker.

"SPKR" - 1 kHz fixed tone will be routed to FM/AM-1200 Speaker only.

8. 1 kHz Tone Level Control
Controls 1 kHz fixed tone level.

9. RF Level Attenuator Control
Controls RF output level of the FM/AM-1200 signal generator in 10 dB steps.

10. RF Level Attenuator Vernier Control
Provides fine adjustment of RF Output Level of FM/AM-1200 Signal Generator, as indicated on dBm/μv scale.

11. T/R Connector
Generator/Receive Connector.

**CAUTION**

DO NOT APPLY MORE THAN 150 WATTS TO THIS CONNECTOR. IRREVERSIBLE DAMAGE TO INTERNAL COMPONENTS OF FM/AM-1200 MAY RESULT.

| ITEM | NAME | DESCRIPTION |
|---|---|---|

12. AUX POWER Connector
+12 V is applied to this connector in Generate and Duplex Generate modes (for the Option 05, Generator Amplifier Only).

13. REF CAL Adjustment
For adjustment of FM/AM-1200 Master Oscillator (TCXO).

14. DUPLEX Output Connector
In Duplex mode, a fixed -60 dB (±10 dB) level (frequency offset by whatever is selected using Keyboard (18)) is present at this connector.

15. EXT MOD/SINAD Connector
Allows application of external modulation when "Generate" Mode is selected. Permits measurement of UUT SINAD and/or Distortion when Modulation METER Control (4) is positioned to "SINAD" or "DIST".

16. DEMOD Connector
Allows external scope monitoring of the demodulated received or generated audio signal.

17. TONE OUT Connector
When either VAR Tone Selector Switch (5) or 1 kHz Tone Selector Switch (7) are positioned to "INTL"; variable, fixed or both tones are present at this connector.

18. Keyboard
Used for data entry and control of FM/AM-1200 microprocessor as described in paragraph 3-3.

19. MIC/ACC Connector
Allows use of external microphone (Ref. appropriate Pin-Out Table in Appendix B).

**NOTE**

With microphone connected, depressing MIC Key will automatically switch FM/AM-1200 internally to generate mode if the Mode Selector Control (39) is in receive or duplex positions.

20. SCOPE Connector
Oscilloscope external input.

21. AC/GND/DC Switch
Allows selection of AC or DC coupling of oscilloscope external input.

| ITEM | NAME | DESCRIPTION |
|---|---|---|

22. PWR/OFF/BATT Switch
Applies/interrupts power to FM/AM-1200 as follows:

"PWR" position - FM/AM-1200 is powered by external AC or DC power source.

"OFF" position - FM/AM-1200 is "OFF".

"BATT" position - FM/AM-1200 is powered by internal battery (This is a momentary spring-loaded switch to the "OFF" position).

**NOTE**

Internal FM/AM-1200 battery is continuously charged when external AC power or external DC power, above 15 VDC, is connected to set, regardless of PWR/OFF/BATT Switch (22) position.

23. Scope VERTICAL Attenuator Vernier Control
Provides adjustment of oscilloscope vertical attenuator rate (amplitude) by a factor of 10.

24. VERTICAL Attenuator Selector Control
Turns power "OFF" to Scope/Analyzer Display.

kHz/%x10 - Allows selection of internal demod audio signal.

V/Div - Allows selection of Scope Connector (20) inputs.

RESID - Displays residual distortion when MODULATION Meter Control (4) is positioned to "SINAD" or "DIST".

25. Scope HORIZONTAL Sweep Vernier Control
Changes Horizontal Sweep rate by a factor of 10.

26. HORIZONTAL Sweep Selector Control
Selects horizontal sweep rate of the oscilloscope or dispersion of Spectrum Analyzer. Dispersion Control functions as follows:

TONE position - Oscilloscope horizontal sweep is driven by waveform output of tone generators.

mS/DIV positions - Represent oscilloscope sweep rate in milli-seconds per division, when Scope Horizontal Sweep Vernier Control (25) is in CAL position (fully clockwise).

**NOTE**

The Spectrum Analyzer operates in the following positions:

MHz/DIV positions
kHz/DIV positions

| HORIZONTAL/DISPERSION | BANDWIDTH |
|---|---|
| 1 kHz/DIV | 300 Hz |
| 2 kHz/DIV | 300 Hz |
| 5 kHz/DIV | 3 kHz |
| 10 kHz/DIV | 3 kHz |
| 20 kHz/DIV | 3 kHz |
| 50 kHz/DIV | 30 kHz |
| .1 MHz/DIV | 30 kHz |
| .2 MHz/DIV | 30 kHz |
| .5 MHz/DIV | 30 kHz |
| 1 MHz/DIV | 30 kHz |

Table 3-3 Horizontal Sweep Selector Control (Analyzer Dispersion Control) Settings

ITEM NAME DESCRIPTION

27. VERT POS Control
Controls vertical position of CRT trace in Oscilloscope and Spectrum Analyzer functions. Spectrum Analyzer function is attenuated and limits this control to nominal 1 division up or down.

28. INT Control
Controls intensity of CRT trace. Clockwise rotation of control increases trace intensity.

**CAUTION**

DO NOT OPERATE CRT DISPLAY (31) WITH EXCESSIVE TRACE INTENSITY. PROGRESSIVE DAMAGE TO CRT MAY RESULT.

29. FOCUS Control
Controls focus of CRT trace.

30. HORIZ POS Control
Controls horizontal position of CRT trace in Oscilloscope and Spectrum Analyzer functions. Spectrum Analyzer function is attenuated and limits this control to nominal 1 DIV left or right.

31. CRT Display
Display screen for both Oscilloscope and Spectrum Analyzer functions.

| ITEM | NAME | DESCRIPTION |
|---|---|---|

32. GEN/LOCK Control
Allows the RF frequency to be slewed off frequency in Generate and Duplex Generate. Acts as a clarifier when receiving SSB.

33. LOCK Lamp
Indicates in the following manner:

Steady Light - RF frequencies are phase locked.

Blinking Light - GEN/LOCK Control (32) is out of the "LOCK" position or FM/AM-1200 is experiencing a malfunction.

34. ANT Connector
External Antenna Input.

**CAUTION**

TO PREVENT DAMAGE TO FM/AM-1200 INTERNAL COMPONENTS, MAXIMUM CONTINUOUS INPUT TO ANTENNA CONNECTOR (34) MUST NOT EXCEED 0.25 WATT.

35. FREQ ERROR Meter Range Selector Control
Selects full scale sensitivity of FREQ ERROR Meter (36) between RF and audio frequency ranges. The audio frequency error is referenced to the Variable Tone Generator.

36. FREQ ERROR Meter
Provides a visual display of the difference between received signal frequency and selected FM/AM-1200 receiver frequency.

Provides a visual display of the difference between the DEMOD audio signal frequency and selected variable tone generator.

37. VFD (Vacuum Fluorescent Display)
Provides display of selected Keyboard entries as described in paragraph 3-3.

38. FREQ ERROR Meter Zero Adjustment
Mechanical zero adjustment for FREQ ERROR Meter (36), when power to FM/AM-1200 is "OFF".

39. MODE Selector Control

GEN Position - Places FM/AM-1200 in the generate mode. Transmitting into the T/R Connector (11), will automatically change FM/AM-1200 "Receive".

REC Position - Places FM/AM-1200 in the receive mode to receive through the ANT Connector (34).

DUP Position - Turns on FM/AM-1200 Duplex Generator, allowing signal output at DUPLEX Output Connector (14) and T/R Connector (11). However, the FM/AM-1200 will remain in the "receive" mode.

**NOTE**

Full receive capability exists, even when transmitting into T/R Connector (11).

DUP GEN Position - Places FM/AM-1200 into generate mode with the Generator on and offset by a pre-programmed amount.

**NOTE**

In this position, automatic receive mode is overridden when transmitting into T/R Connector (11) with external transmitter. The DUP GEN Output is only available at the T/R Connector (11) with the level controlled by the RF Level Attenuator Control (9).

40. VOLUME Control
Controls volume of FM/AM-1200 speaker.

41. SQUELCH Control
Controls receiver squelch threshold. Squelch disables audio output, freq error and modulation indicators when RF input at ANT Connector (34) falls below squelch threshold.

## 3-2 FM/AM-1200 REAR PANEL

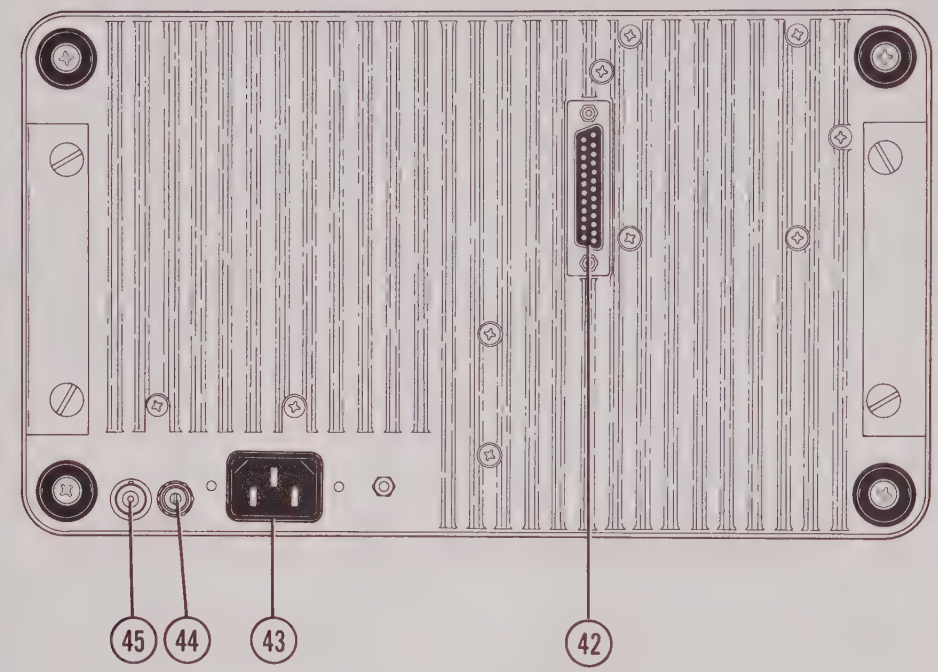



Figure 3-3 FM/AM-1200 Rear Panel Connectors

42. RS-232 Connector
43. AC Power Input Connector
44. DC Power Input Connector
45. External Reference Connector

| ITEM | NAME | DESCRIPTION |
|---|---|---|

42. RS-232 Connector
Female connector for interface with external RS-232 compatible keyboard (Ref. appropriate Pin-Out Table in Appendix B).

43. AC Power Input Connector
AC power input connector for 105-130/210-260 VAC supply at 50 to 400 Hz.

44. DC Power Input Connector
DC power connector for 12 to 30 VDC supply.

45. External Reference Connector
Allows monitoring of 10 MHz internal reference frequency or the application of an external 10 MHz reference frequency. The input and output are automatically switched.

**NOTE**

Automatic switching to external source occurs when an external 10 MHz reference frequency of +5 dBm to +20 dBm is applied at External Reference Connector. DO NOT EXCEED ¼ WATT INPUT.

## 3-3 KEYBOARD AND VFD DESCRIPTION

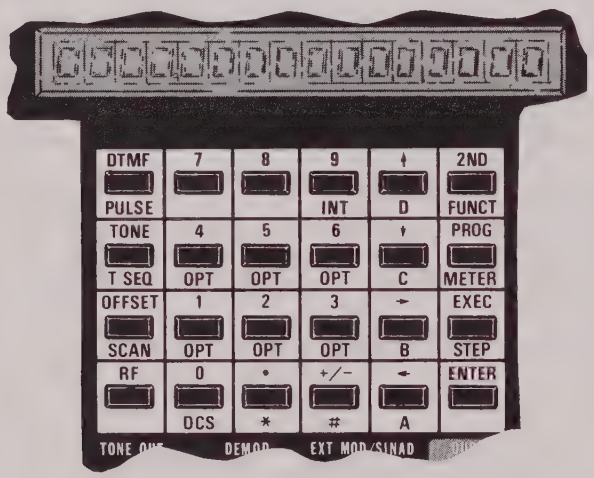



Figure 3-4 Keyboard and VFD Layout

The FM/AM-1200 Keyboard and VFD (Vacuum Fluorescent Display) provides a means of entering data into the microprocessor to control the various operating parameters of the RF frequency, tone generator and duplex generator offset frequency. Normal Keyboard operation involves the following three basic types of key entry sequences:

| ITEM | NAME | DESCRIPTION |
|---|---|---|

1. "DIRECT" MODE
   Key entries allow simultaneous programming and execution.

2. PROGRAM MODE
   PROG Key entries allow retrieval, edit and storage without the execution.

3. EXECUTE MODE
   EXEC Key entries allow retrieval and automatic execution without edit capability.

The primary objective of this subsection is to familiarize the operator with the methods of making keyboard entries. A complete description of the Keyboard and VFD operation is located in SECTION 4.

The FM/AM-1200 Keyboard consists of 24 keys which provide a means of entering data into the microprocessor to control the frequency of the signal generator, receiver, duplex generator offset and tone generator functions.

### 3-3-1 FUNCTION KEYS

These keys determine what FM/AM-1200 function is selected by the operator. Most keys have a dual function which will select either the 1st order functions (DTMF, TONE, OFFSET and RF) or 2nd order functions (PULSE, T SEQ, SCAN, DCS, INT, STEP, METER and a selection of 6 additional options).

1st ORDER FUNCTIONS (Black Lettering on Keyboard)

These functions are used to set the operating parameters of:

- Dual Tone Multiple Frequency (DTMF)
- Variable Tone Generator (TONE)
- Duplex Offset Generator Frequency (OFFSET)
- Signal Generator or Receiver Frequencies (RF)

2nd ORDER FUNCTIONS (Blue Lettering on Keyboard)

All second order function keys must be preceded by the "2ND FUNCT" Key.

- FREQ ERROR and Modulation Meter Indications (METER)
- Mobile Pulse Dialing/IMTS (PULSE)
- Tone ON/OFF Duration Selection (TSEQ)
- RF Program Function (SCAN)
- Digitally Coded Squelch (DCS)
- Step Function (STEP)
- VFD Intensity (INT)
- FM/AM-1200 Future Expansion (OPT)

### 3-3-2 INSTRUCTION KEYS

These keys instruct the FM/AM-1200 processor to perform a specific operation or function to permit the execution of a key entry. Specific key functions are as follows:

2ND FUNCT Key - Conditions the FM/AM-1200 processor for a 2nd order function entry; this key must precede the 2nd function entry. When this key is depressed, the VFD will display "2ND FUNCTION".

PROG Key - Allows entry into the programming parameters of the FM/AM-1200. All Keyboard entries are immediately displayed on the VFD but will not be executed by the processor.

EXEC Key - Retrieves stored data and automatically executes the data.

ENTER Key - Instructs processor that the preceding key-in sequence has been completed (i.e., RF Freq's, DTMF Sequences, etc.). Depress ENTER Key twice to exit from execute mode and return to the direct mode.

### 3-3-3 CURSOR CONTROL KEYS

The ← and → Keys will move the cursor laterally within the VFD viewing area for purposes of changing data values. To change a data value, the cursor must be positioned directly on the desired character position prior to making a value change. The ↑ and ↓ Keys are used to increment (↑) or decrement (↓) any value positioned in the cursor and any adjacent values which are affected by "carry" and "borrow" operations. In addition, the ↑ or ↓ keys are used to slew thru the stored memory fields.

### 3-3-4 DATA ENTRY KEYS

These keys include standard numerical value keys from 0 through 9, as well as eight special symbol keys which are used to enter:

1. Decimal point (Justifies Tone, Offset and RF Fields)
2. A change of sign (+/-) (Used with Offset and DCS functions only)
3. A, B, C, D, # and * (telephone associated symbols), used in conjunction with the DTMF or PULSE function.

**NOTE**

A, B, C, D, # and * are also used for program preset position selections 10 thru 15. These data entry keys must be preceded by the 2nd Function Key.

# SECTION 4 - OPERATION

## 4-1 GENERAL

On power-up, the FM/AM-1200 initiates a memory check. If no error is indicated on VFD (37), the last RF Frequency is executed and displayed on VFD (37), indicating the test set is ready for direct operation.

The FM/AM-1200 has three modes of operation which are explained in the following paragraphs. The three modes of operation are:

1. Direct Data Entry
2. Programmed Data Entry into memory
3. Executed Data Entry from memory

4-1-1 Mini-Index of Contents Within This Section. (Refer to Table of Contents in Front of Manual for a Complete Listing).


| Paragraph | Title | Page |
|---|---|---|
| KEYBOARD AND VFD OPERATION | | |
| 4-2 | Direct Data Entry | 4-2 |
| 4-3 | Programmed Data Entry Into Memory | 4-8 |
| 4-4 | Executed Data Entry | 4-19 |
| BASIC OPERATING PROCEDURES | | |
| 4-5 | Receiver Operation | 4-25 |
| 4-6 | RF Signal Generator Operation (Simplex) | 4-31 |
| 4-7 | Duplex Operation | 4-37 |
| 4-8 | Oscilloscope Operation | 4-41 |
| 4-9 | Spectrum Analyzer Operation | 4-45 |
| 4-10 | Tone Generator Operation | 4-47 |
| RS-232 OPERATION | | |
| 4-11 | Basic RS-232 Operation | 4-49 |

## 4-2 DIRECT DATA ENTRY

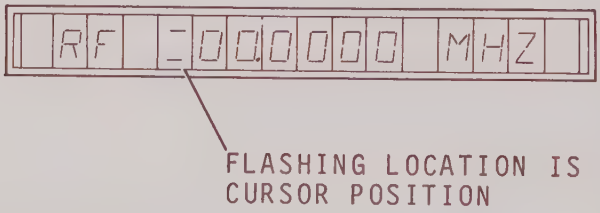
The following steps describe the methods of making direct keyboard entries to control the FM/AM-1200 RF Frequency, Offset Generator Frequency and Tone Generator Functions. Once a particular function key is depressed, the FM/AM-1200 assumes a programming/edit and execution mode of operation. In this mode, the FM/AM-1200 will execute each key entry, as it is selected, while allowing the operator the capability to edit programmed data indicated on the VFD (37).

**CAUTION**

ANY CHANGES IN DATA WHEN OPERATING IN THE DIRECT MODE WILL CAUSE CHANGES TO THE PRE-PROGRAMMED MEMORY SETTINGS.

### 4-2-1 Direct RF Data Entry

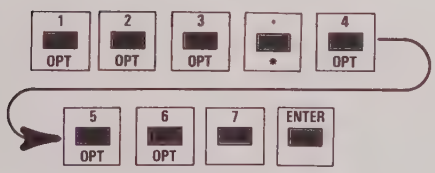
KEY ENTRY | VFD (37) INDICATES




Directly enter the desired RF Frequency using the keyboard digits.

EXAMPLE: Enter RF Frequency of 123.4567 MHz.

KEY ENTRY | VFD (37) INDICATES



### 4-2-2 Direct Tone Entry

| KEY ENTRY | ACTION |
|---|---|
| DEPRESS TONE Key | Selected function appears on left side of VFD (37) and VFD cursor is positioned on first character. |

**NOTE**

To monitor tone, select "SPKR" with VAR Tone Selector Switch (5) and adjust VAR Tone Level Control (6) to a comfortable listening level. If no key is depressed after approximately 6 seconds, selection will default to the RF function.

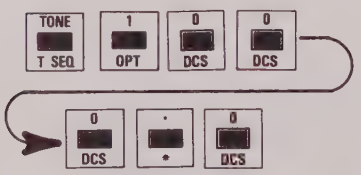
Operator's Choice: Selected number character will be displayed, in pro-
0 thru 9 gression, on VFD (37).

**NOTE**

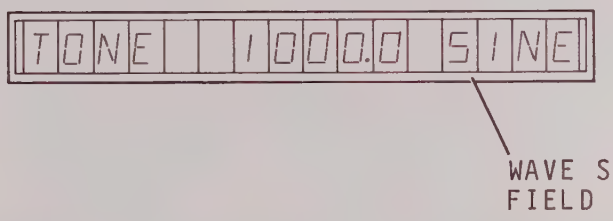
While each number key is depressed, its assigned tone will be generated and the selected characters will appear, in order of selection, on VFD (37). To terminate a completed entry, depress the "ENTER" Key.

EXAMPLE: Direct TONE Entry

KEY ENTRY




VFD (37) INDICATES




EXAMPLE: Wave Shape Selection

To change wave shape, use → Key to move cursor to the right until waveform title flashes. Use the ↑ or ↓ Keys to change wave shape.

(See example on following page for sample wave shapes.)

Alternate Method For
Changing Wave Shape:

ENTER Ø for Sinewave
1 for Square Wave
2 for Ramp Wave
3 for Triangle
Wave

SINE WAVE

SQUARE WAVE

RAMP WAVE

TRIANGLE WAVE

Depress

Key.

4-2-3 Direct DTMF and PULSE Entries

| KEY ENTRY | ACTION |
|---|---|
| DTMF or PULSE | Selected function appears on left side of VFD (37) and VFD cursor is positioned on first character. |

**NOTE**

If no key is depressed after approximately 6 seconds, selection will default to RF function.

To monitor tones, select "SPKR" with VAR Tone Selector Switch (5) and adjust VAR Tone Level Control (6) to a comfortable listening level.

| | |
|---|---|
| Operator's Choice: Ø thru 9, A thru D, # and/or * | Selected character (number, letter or symbol) will be displayed, in progression, on VFD (37). |

EXAMPLE: Display DTMF 0123456789ABCD#*

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| DTMF PULSE, 0 DCS, 1 OPT, 2 OPT, 3 OPT, 4 OPT | DTMF 01234 |
| | Displaying Five Digit Number |
| 5 OPT, 6 OPT, 7, 8, 9 INT | DTMF 0123456789 |
| | Displaying Ten Digit Number |
| 2ND FUNCT | 2ND FUNCTION |
| A | DTMF 0123456789A |
| | Displaying Eleven Digit Number |
| 2ND FUNCT, B | TMF 0123456789AB |
| | Displaying Twelve Digit Number |
| 2ND FUNCT, C | MF 0123456789ABC |
| | Displaying Thirteen Digit Number |
| 2ND FUNCT, D | F 0123456789ABCD |
| | Displaying Fourteen Digit Number |
| 2ND FUNCT, +/- # | 0123456789ABCD# |
| | Displaying Fifteen Digit Number |
| 2ND FUNCT, . * | 0123456789ABCD#* |
| | Displaying Sixteen Digit Number |

EXAMPLE: Display Pulse Ø1234567890ABCD#*.

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| 2ND FUNCT | 2ND FUNCTION |
| DTMF PULSE | PULSE |

Proceed with sequence as in DTMF example.

Depress ENTER Key.

**NOTE**

Initial pulse tone is the standard IMTS capture tone.

4-2-4 Direct OFFSET Entry

The OFFSET key is used to set the DUPLEX OFFSET Frequency. The duplex generator frequency is the receiver frequency plus the offset frequency.

| KEY ENTRY | ACTION |
|---|---|
| OFFSET | OFFSET appears on left side of VFD (37) and VFD cursor is positioned on first character. |
| Operator's Choice: Ø thru 9, +/- | Selected character (number) will be displayed on VFD (37). |

EXAMPLE: Enter DUPLEX OFFSET of +1.23 MHz.

KEY ENTRY VFD (37) INDICATES

OFFSET + 1.23 MHZ

+/- # key is used to change sign.

Depress ENTER Key.

4-2-5 Meter Function

VFD (37) will digitally indicate FREQ ERROR Meter (37) and MODULATION Meter (1) readings, as selected by FREQ ERROR Meter Range Selector Control (35) and Modulation METER Control (4).

KEY ENTRY

VFD (37) INDICATES

WATTS AVERAGE =


SINAD =


DISTORTION =


SIGNAL =


BATTERY TEST =


WATTS PEAK =


MODULATION =


## 4-2-6 Set Intensity (VFD)

1st Order Numbers Ø thru 9 will change VFD intensity to a preset level corresponding to number depressed (Ø = minimum and 9 = maximum). ↑ or ↓ Keys will slew intensity from minimum to maximum in approximately 4 seconds.

KEY ENTRY

VFD (37) INDICATES

## 4-3 PROGRAMMED DATA ENTRY INTO MEMORY

The "PROG" Key is used to program up to sixteen different memory locations in the FM/AM-1200. The following functions can be programmed:

| | |
|---|---|
| RF | DTME/PULSE |
| TONE | OFFSET |

The following functions can only be programmed for one preset input:

| | |
|---|---|
| T SEQ | STEP (RF) |
| SCAN | STEP (TONE) |
| DCS | |

### 4-3-1 Programmed RF Memory

KEY ENTRY

VFD (37) INDICATES

Program any one of the memory locations by selecting the number, letter, or symbol corresponding to that memory location as shown in Table 4-1.

| Key | Memory Location |
|---|---|
| Ø | = Ø |
| 1 | = 1 |
| 2 | = 2 |
| 3 | = 3 |
| 4 | = 4 |
| 5 | = 5 |
| 6 | = 6 |
| 7 | = 7 |
| 8 | = 8 |
| 9 | = 9 |

| Key | Memory Location |
|---|---|
| 2nd/A | = 1Ø |
| 2nd/B | = 11 |
| 2nd/C | = 12 |
| 2nd/D | = 13 |
| 2nd/# | = 14 |
| 2nd/* | = 15 |

Table 4-1 Program Memory Locations

KEY ENTRY VFD (37) INDICATES

Enter desired frequency into memory.

**NOTE**

Leave memory location "Ø" for the direct mode operation because it will change the stored memory data.

EXAMPLE: Program Memory Location "1Ø".

KEY ENTRY VFD (37) INDICATES

Enter desired frequency into memory.

Depress

Key.

## 4-3-2 Programmed Tone Memory

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| PROG METER | |
| TONE T SEQ | |

Program any one of the memory locations by selecting the number, letter or symbol corresponding to that memory location as shown in Table 4-1.

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| 1 OPT | |

Enter desired 6-digit frequency into memory.

**NOTE**

After last digit of tone frequency is entered, cursor will flash over waveform.

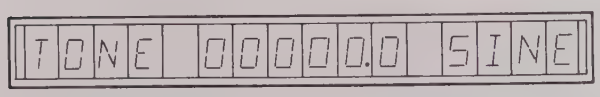
Enter desired waveform.

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| 0 DCS | |
| 1 OPT | |
| 2 OPT | |
| 3 OPT | |

**NOTE**

↑ and ↓ cursor can be used to scroll through waveforms.

EXAMPLE: Program Memory Location "15".

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| PROG METER | |
| TONE T SEQ | |
| 2ND FUNCT | |
| . * |   |

Enter desired frequency and waveform.

Depress ENTER Key.

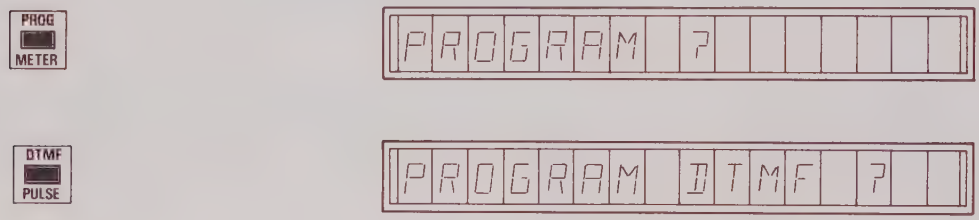
**NOTE**

Leave memory location "Ø" for the direct mode operation because it will change the stored memory data.

4-3-3 Programmed DTMF and PULSE Memory

DTMF and PULSE functions use the SAME memory location.

KEY ENTRY VFD (37) INDICATES



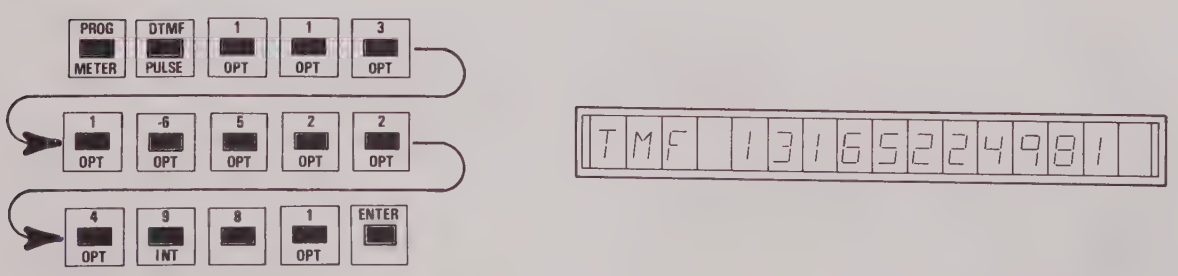

Program any one of the memory locations by selecting the number, letter or symbol corresponding to that memory location as shown in Table 4-1.

KEY ENTRY VFD (37) INDICATES

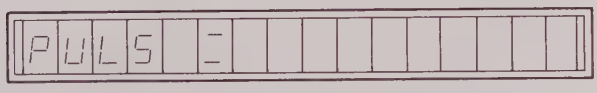
Enter the desired telephone number (16 digits available) into memory.

EXAMPLE: Program Telephone Number 1-316-522-4981 into Memory Location "3".

KEY ENTRY VFD (37) INDICATES



EXAMPLE: Program memory location "12".

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| PROG METER | |
| 2ND FUNCT | |
| DTMF PULSE | |
| 2ND FUNCT | |
| I C |  |

Enter desired IMTS telephone number.

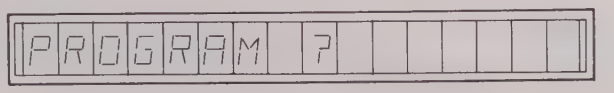
Depress ENTER Key.

**NOTE**

The digit under the cursor and all digits to the right of the cursor will be blanked upon depressing the ENTER Key.

Leave memory location "Ø" for the direct mode operation because it will change the stored memory data.

4-3-4 Programmed OFFSET Memory

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| PROG METER |  |
| OFFSET SCAN | |

Program any one of the memory locations by selecting the number, letter or symbol corresponding to that memory location as shown in Table 4-1.

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| 1 OPT | OFFSET +-0.00 MHZ |
| +/- # | KEY IS USED TO CHANGE SIGN |

Enter desired offset frequency into memory. Depress ENTER Key.

**NOTE**

Maximum frequency is ±49.99. Any frequency above ±49.99 will default to ±49.99 although the entered frequency will be displayed on VFD (37).

**NOTE**

Leave memory location Ø for the direct mode operation because it will change the stored memory data.

4-3-5 Programmed DCS Memory

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| PROG METER | PROGRAM ? |
| 2ND FUNCT | 2ND FUNCTION |
| 0 DCS | DCS -00 NORMAL |
| | INVERT |

**NOTE**

+/- Key will change polarity between INVERT and NORMAL.

Enter desired DCS Code and Polarity into memory.

Depress ENTER Key.

4-3-6 Programmed T SEQ Memory

T SEQ programs the ON time and OFF time of each of the 16 tone memory locations. All 16 (Ø thru 15) locations must be programmed as all tone locations will be executed in sequential order.

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| PROG METER | PROGRAM ? |
| 2ND FUNCT | 2ND FUNCTION |
| TONE T SEQ | T 1 0.000 0.000 |

TONE MEMORY LOCATION NUMBER — ON TIME — OFF (DEAD) TIME

Use ↓ C Key to set tone memory location number to zero. T 0

**NOTE**

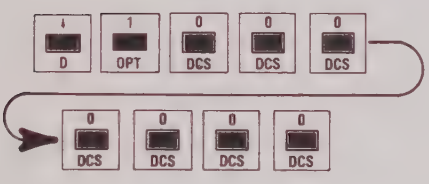
↑ and ↓ Key in the T SEQ Mode are used to scroll through the tone memory location numbers only.

KEY ENTRY

VFD (37) INDICATES

Tone memory location is now programmed for no "ON TIME" and no "OFF (DEAD) TIME" causing the FM/AM-1200 to ignore the tone stored in memory location "Ø" from the tone sequence.

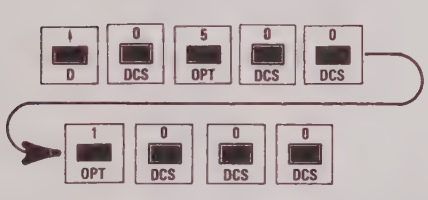
KEY ENTRY




VFD (37) INDICATES

The above key entry sequence programmed tone "1" memory location for an "ON TIME" of 1.Ø Sec. and for no dead time between execution of the next tone.

KEY ENTRY




VFD (37) INDICATES

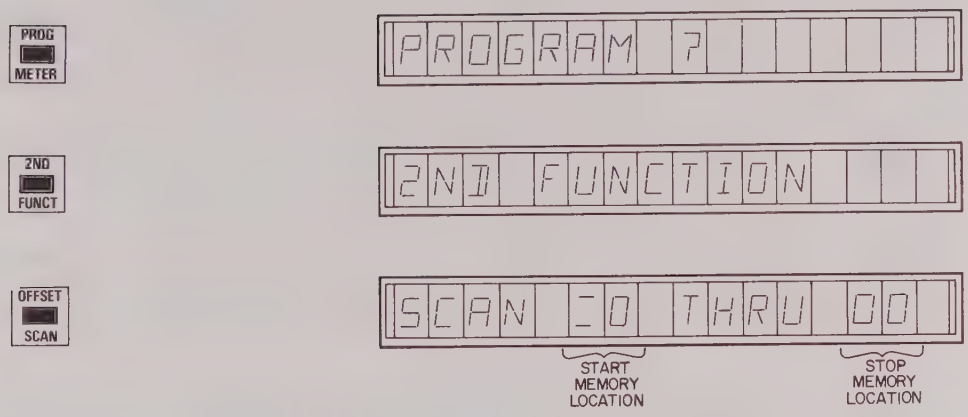
The above key entry sequence programmed tone "2" memory location for an "ON TIME" of Ø.5 Sec. and an "OFF TIME" of 1.Ø Sec before execution of next tone.

4-3-7 Programmed SCAN Memory

SCAN programs the section of RF memory locations Ø thru 15.

KEY ENTRY

VFD (37) INDICATES




The program will scan sequentially through the RF memory locations beginning with the start memory location entry and ending with the stop memory location. Upon reaching the programmed stop memory location, the scan sequence automatically repeats, beginning at the programmed start memory location.

KEY ENTRY

VFD (37) INDICATES

The SCAN will remain at the RF memory location for the programmed resume time if squelch is broken.

4-3-8 Programmed STEP Memory

The STEP Key is used in conjunction with the RF and/or TONE functions. It provides a means of stepping the last executed frequency up or down at a pre-selected increment.

EXAMPLE: Programming STEP (RF)

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| PROG METER | PROGRAM ? |
| 2ND FUNCT | 2ND FUNCTION |
| EXEC STEP | STEP ? |
| RF | RF = 0.00000 MHZ |

Enter desired step frequency.

Depress ENTER Key.

EXAMPLE: Programming STEP (TONE)

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| PROG METER | PROGRAM ? |
| 2ND FUNCT | 2ND FUNCTION |
| EXEC STEP | STEP ? |
| TONE T SEQ | STEP = 0.0 HZ |

Enter desired step frequency.

Depress ENTER Key.

**NOTE**

Do not depress ↑ or ↓ Key while programming STEP function.

## 4-4 EXECUTED DATA ENTRY

The "EXEC" Key retrieves and executes the programmed memory with no edit capability. To exit from this mode and return to the direct mode, depress ENTER Key twice.

### 4-4-1 EXECUTING RF Functions

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| EXEC STEP | EXECUTE ? |
| RF | EXECUTE RF ? |

Select Desired RF memory location (Ref Table 4-1).

### 4-4-2 Executing TONE Functions

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| EXEC STEP | EXECUTE ? |
| TONE T SEQ | EXECUTE TONE ? |

Select desired TONE memory location (Ref Table 4-1).

## 4-4-3 Executing DTMF/PULSE Functions

### DTMF Function

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| EXEC STEP | EXECUTE ? |
| DTMF PULSE | EXECUTE DTMF ? |

Select desired DTMF memory location (Ref Table 4-1).

### PULSE Function

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| EXEC STEP | EXECUTE ? |
| 2ND FUNCT | 2ND FUNCTION |
| DTMF PULSE | EXECUTE PULSE ? |

Select desired PULSE memory location (Ref Table 4-1).

**NOTE**

The blinking digit is the one being executed.

## 4-4-4 Executing OFFSET Function.
(Active in DUP and DUP GEN Modes only).

KEY ENTRY VFD (37) INDICATES

Select desired OFFSET memory location (Ref. Table 4-1).

4-4-5 Executing SCAN Function

KEY ENTRY VFD (37) INDICATES

Reference paragraph 4-3-7 for a detailed explanation of the SCAN function.

4-4-6 Executing DCS Function

FM/AM-1200 will transmit entered DCS code only when MODE Selector Control (39) is in "GEN" position. With MODE Selector Control (39) in "REC" position, the VFD (37) will indicate selected DCS code only when it is received.

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| EXEC STEP | EXECUTE ? |
| 2ND FUNCT | 2ND FUNCTION |
| 0 DCS | DCS 777 INVERT |
| | Selected DCS Code Received or Generated |
| | DCS ---- INVERT |
| | DCS Code Not Received |

## 4-4-7 Executing T SEQ Function

Tone sequence will execute all preset tone memory locations (Ø thru 15) which are programmed with an "ON TIME".

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| EXEC STEP | EXECUTE ? |
| 2ND FUNCT | 2ND FUNCTION |
| TONE T SEQ | TONE 000000 SINE |

**NOTE**

The tone displayed on the VFD (37) is the tone being executed. The last tone executed will remain displayed although the tone generator is turned off.

### 4-4-8 Executing STEP (RF and TONE) Function

This function steps the last executed frequency up or down at the pre-programmed increment.

RF STEP Function

| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| EXEC STEP | EXECUTE ? |
| 2ND FUNCT | 2ND FUNCTION |
| EXEC STEP | STEP ? |
| RF | STEP 000.0000 MHZ |

Depress ↑ or ↓ Key to step the RF Frequency up or down by the pre-programmed increment.

## TONE STEP FUNCTION

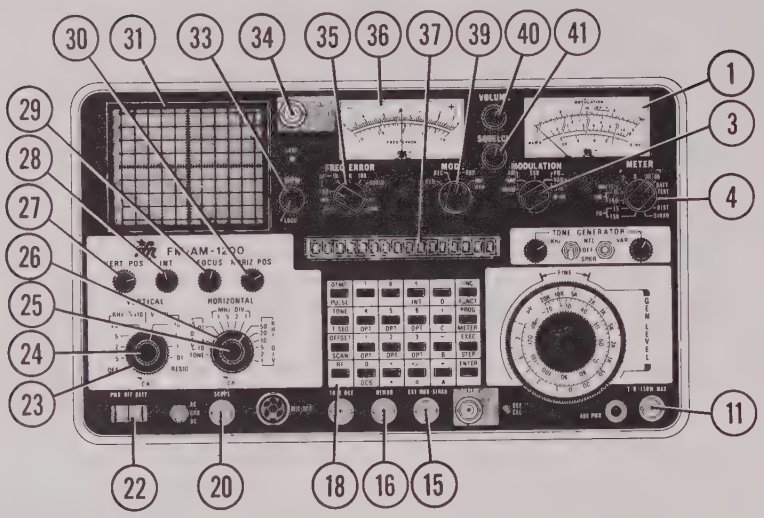
| KEY ENTRY | VFD (37) INDICATES |
|---|---|
| EXEC STEP | |
| 2ND FUNCT | |
| EXEC STEP | |
| TONE T SEQ | |

Depress ↑ or ↓ Key to step the Tone Frequency up or down by the pre-programmed increment.

**NOTE**

Once the STEP Function has been selected and the desired increment entered, the step function will remain valid until a Function Key is depressed.

## 4-5 RECEIVER OPERATION




FM/AM-1200 CONNECTORS AND INDICATORS APPLICABLE TO RECEIVER OPERATION:

1 MODULATION Meter
11 T/R Connector
15 EXT MOD/SINAD Connector
16 DEMOD Connector
20 SCOPE Connector
31 CRT Display
34 ANT Connector
36 FREQ ERROR Meter
37 VFD

Figure 4-1 FM/AM-1200 Front Panel Controls Applicable to Receiver Operation

| | CONTROL | SETTING |
|---|---|---|
| 3 | MODULATION Select Control | As req'd |
| 4 | Modulation METER Control | As req'd |
| 18 | Keyboard | As req'd |
| 22 | PWR/OFF/BATT Switch | "PWR" or "BATT" |
| 23 | Scope VERTICAL Attenuator Vernier Control | As req'd |
| 24 | VERTICAL Attenuator Selector Control | As req'd |
| 25 | Scope HORIZONTAL Sweep Vernier Control | As req'd |
| 26 | HORIZONTAL Sweep Selector Control | As req'd |
| 27 | VERT POS Control | As req'd |
| 28 | INT Control | As req'd |
| 29 | FOCUS Control | As req'd |
| 30 | HORIZ POS Control | As req'd |
| 32 | GEN/LOCK Control | Full ccw, detent |
| 35 | FREQ ERROR Meter Range Selector Control | As req'd |
| 39 | MODE Selector Control | "REC" |
| 40 | VOLUME Control | As req'd |
| 41 | Squelch Control | As req'd |

Table 4-2 FM/AM-1200 Front Panel Controls Applicable to Receiver Operation

## 4-5-1 GENERAL

The FM/AM-1200 contains a communications receiver capable of monitoring AM, FM, and SSB signals within a range of 250 kHz and 999.9999 MHz. Signals may be monitored "off-the-air" using an external antenna or by direct cable connection to the front panel T/R Connector (11). Table 4-3 defines the signal parameters which can be monitored using the receiver and associated monitoring functions.

| SIGNAL CHARACTERISTIC(S): | MONITORING DEVICES | CONTROL SETTINGS: |
|---|---|---|
| Demodulated * AM or FM | MODULATION Meter (1) | Modulation METER Control (4) to desired "kHz/%X10". MODULATION Select Control (3) as req'd. |
| | CRT (31) (Oscilloscope) | VERTICAL Attenuator Selector Control (24) to desired "kHz/%X10 position. |
| | VFD (37) | Depress "2nd FUNCT" and "METER" Keys (in that order). |
| | Speaker | Volume control (40) as req'd. |
| RF and AUDIO Error* | FREQ ERROR Meter (36) | FREQ ERROR Meter Range Selector Control (35) as req'd. |
| | VFD (37) | Depress "2nd FUNCT" and "METER" Keys (in that order). |
| AUDIO Error* (Lissajou Pattern) | CRT (31) | HORIZONTAL Selector Control (26) to tone, VERTICAL Selector Control (24) to desired kHz/%X10. |

* When the received signal input level is below the FM/AM-1200 squelch threshold, these monitoring functions will be disabled.

Table 4-3 Receiver Monitoring Capabilities

Table 4-3 (Cont'd)

| SIGNAL CHARACTERISTIC(S): | MONITORING DEVICE(S): | CONTROL SETTINGS: |
|---|---|---|
| Transmitter Power (WATTS) (T/R Connector (11) only) | MODULATION Meter (1)<br><br>or<br><br>VFD (37)<br><br>CRT Display (31) (Spectrum Analyzer) | Modulation Meter Control (4) to desired "WATTS" selection.<br><br>Depress "2nd FUNCT" and "METER" Keys (in that order).<br><br>HORIZONTAL Sweep Selector Control (26) clockwise to 1 MHz/DIV or less. |
| Relative Signal Strength | MODULATION Meter (1)<br><br>VFD (37) | Modulation METER Control (4) to "SIG".<br><br>Depress "2nd FUNCT" and "METER" keys (in that order) |

Table 4-3 Receiver Monitoring Capabilities

4-5-2 BASIC RECEIVER OPERATION

Basic operation of the FM/AM-1200 receiver is as follows:

1. If signals are to be monitored "off-the-air", connect external antenna to ANT Connector (34); if signals are to be received by direct cable connection, apply signal to T/R Connector (11).

**CAUTION**

MAXIMUM CONTINUOUS INPUT TO ANTENNA CONNECTOR (34) MUST NOT EXCEED 0.25 WATTS.

MAXIMUM INPUT TO T/R CONNECTOR (11) MUST NOT EXCEED 150 WATTS.

TIME LIMTS FOR MEASUREMENT OF TRANSMITTER OUTPUT T/R CONNECTOR (11) IS:

150 W = 1 minute "ON", 5 minute "OFF".
↓
100 W = 1½ minutes "ON", 4 minutes "OFF".
↓
75 W = 2 minutes "ON", 2 minutes "OFF".
↓
50 W = Maximum continuous.

2. Using Keyboard (18), set FM/AM-1200 to desired RF frequency.

4-5-3 RECEIVING AM OR FM SIGNALS (OFF-THE-AIR)

1. Perform "BASIC RECEIVER OPERATION" steps described in paragraph 4-5-2.

2. Place MODULATION Select Control (3) to:

   a. "AM NORM" or "AM NAR" position, if receiving AM signals.

   b. "FM WIDE", "FM MID" or "FM NAR" position, if receiving FM signals.

3. To aurally monitor received audio, adjust VOLUME Control (40) and SQUELCH Control (41) as required.

4. Use monitoring features outlined in Table 4-3 to monitor desired signal parameters.

4-5-4 RECEIVING SSB SIGNALS (OFF-THE-AIR)

1. Perform "BASIC RECEIVER OPERATION" steps described in paragraph 4-5-2.

2. Place MODULATION Select Control (3) to "SSB" position.

3. To aurally monitor audio, adjust VOLUME Control (40) and SQUELCH control (41) as required.

4. Use GEN/LOCK Control (32) as a clarifier.

| MODULATION SELECT CONTROL POSITION | DEMODULATION MODE | PRE-DETECTION BANDWIDTH | POST-DETECTION BANDWIDTH |
|---|---|---|---|
| AM | | | |
| NAR | AM | 6 kHz | 8 kHz |
| NORM | AM | 15 kHz | 8 kHz |
| SSB | SSB | 6 kHz | 8 kHz |
| FM | | | |
| NAR | FM | 15 kHz | 8 kHz |
| MID | FM | 200 kHz | 8 kHz |
| WIDE | FM | 200 kHz | 80 kHz |

Table 4-4 Modulation Select Control Positions

## 4-5-5 TESTING AM OR FM TRANSMITTERS

**CAUTION**

MAXIMUM INPUT TO T/R CONNECTOR (11) MUST NOT EXCEED 150 WATTS.

MAXIMUM TIME LIMITS FOR MEASUREMENT OF TRANSMITTER OUTPUT USING T/R CONNECTOR (11) IS:

150 W = 1 MINUTE "ON", 5 MINUTES "OFF".
↓
100 W = 1½ MINUTES "ON", 4 MINUTES "OFF".
↓
75 W = 2 MINUTES "ON", 2 MINUTES "OFF".
↓
50 W = MAXIMUM CONTINUOUS.

1. Perform "BASIC RECEIVER OPERATION" steps described in paragraph 4-5-2.

**NOTE**

Connect 50Ω coaxial cable between output of transmitter under test and FM/AM-1200 T/R Connector (11).

2. Position MODULATION Select Control (3) to:

   a. AM "NORM" or "NAR" position if testing AM transmitters.

   b. FM "NAR", "MID" or "WIDE" position, if testing FM transmitters.

3. Use monitoring features outlined in Table 4-6 to monitor desired signal parameters.

## 4-5-6 MEASURING AM OR FM TRANSMITTER DISTORTION

1. Perform "BASIC RECEIVER OPERATION" steps described in paragraph 4-5-2.

**NOTE**

Connect 50Ω coaxial cable between output of transmitter under test and FM/AM-1200 T/R Connector (11).

2. Modulate transmitter under test with a fixed 1 kHz tone.

**NOTE**

FM/AM-1200 1 kHz Tone Generator (fixed) function should be used as a modulation source.

Measurement accuracy is dependent on accuracy of 1 kHz tone.

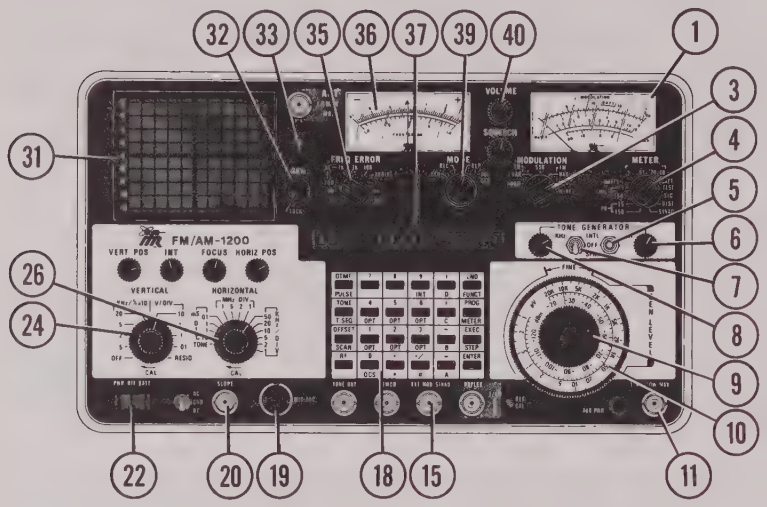
3. Position Modulation METER Control (4) to "DIST".

4. Connect coax cable between FM/AM-1200 DEMOD Connector (16) and EXT MOD/SINAD Connector (15).

5. Monitor DIST Level on top scale of MODULATION Meter (1).

6. Place VERTICAL Attenuator Selector Control (24) to "RESID" position to observe residual distortion on oscilloscope.

## 4-6 RF SIGNAL GENERATOR OPERATION (SIMPLEX)




FM/AM-1200 CONNECTORS AND INDICATORS APPLICABLE TO RF SIGNAL GENERATOR OPERATION:

| | |
|---|---|
| 1 | MODULATION Meter |
| 11 | T/R Connector |
| 15 | EXT MOD/SINAD Connector |
| 19 | MIC/ACC Connector |
| 20 | SCOPE Connector |
| 31 | CRT Display |
| 33 | LOCK Lamp |
| 36 | FREQ ERROR Meter |
| 37 | VFD |

Figure 4-2 FM/AM-1200 Front Panel Controls Applicable to RF Signal Generator Operation

| | CONTROL | SETTING |
|---|---|---|
| 3 | MODULATION Select Control | "FM NAR" |
| 4 | Modulation METER Control | "kHz/%X10 position 6" |
| 5 | VAR Tone Selector Switch | "OFF" |
| 6 | VAR Tone Level Control | As req'd |
| 7 | 1 kHz Tone Selector Switch | "OFF" |
| 8 | 1 kHz Tone Level Control | As req'd |
| 9 | RF Level Attenuator Control | "-50 dBm" |
| 10 | RF Level Attenuator Vernier Control | ".5K µV" |
| 18 | Keyboard | "RF Frequency 150.2000 MHz" |
| 22 | PWR/OFF/BATT Switch | "PWR" or "BATT" |
| 24 | VERTICAL Attenuator Selector Control | "2 kHz/%X10" |
| 26 | HORIZONTAL Sweep Selector Control | "1 mS/DIV" |
| 32 | GEN/LOCK Control | "LOCK" |
| 35 | FREQ ERROR Meter Range Selector Control | 10K |
| 39 | MODE Selector Control | "GEN" |
| 40 | VOLUME Control | As req'd |

Table 4-5 FM/AM-1200 Front Panel Controls Applicable to RF Signal Generator Operation

## 4-6-1 GENERAL

The FM/AM-1200 RF signal generator is capable of generating calibrated amplitude signals within a range of 250 kHz to 999.9999 MHz, in 100 Hz steps. The signal generator can be used to stimulate external devices by generating modulated or unmodulated signals, while the FM/AM-1200 receiver is simultaneously monitoring the generator. Modulation signals for the generated carrier are available from the FM/AM-1200 internal tone generators or from external audio sources. A microphone input connector is also available for applying voice modulation. The generated signals are transmitted out the FM/AM-1200 front panel T/R Connector (11), at an output level which is continuously variable from -20 to -128 dBm (using RF Level Attenuator Controls (9) and (10)).

Table 4-6 outlines the parameters of the generated output, which can be monitored by the FM/AM-1200 receiver circuits during generator operation.

| SIGNAL CHARACTERISTICS: | MONITORING DEVICE(S): | CONTROL SETTINGS: |
|---|---|---|
| Demodulated Audio | MODULATION Meter (1) | Modulation METER Control (4) to desired "kHz/%X10". MODULATION Select Control (3) as required. |
| | CRT (31) (Oscilloscope) | VERTICAL Attenuator Selector Control (24) to kHz/%X10 position. HORIZONTAL Sweep Selector Control (26) to ms/Div position. |
| | VFD (37) | Depress "2ND FUNCT" and "METER" Keys (in that order.) |
| | SPEAKER | Volume Control (40) as required. |

Table 4-6 Receiver Monitoring Capabilities of Generated Output

Table 4-6 (Cont'd)

| SIGNAL CHARACTERISTICS: | MONITORING DEVICE(S): | CONTROL SETTINGS: |
|---|---|---|
| #RF ERROR<br>or<br>*AUDIO ERROR | FREQ ERROR Meter (36) | FREQ ERROR Meter Range Selector Control (35) as req'd. |
| | VFD (37) | Depress "2ND FUNCT" and "METER" Keys (in that order). |

# Used with GEN/LOCK Control (32)
* Audio error is measured through EXT MOD/SINAD Connector (15).

Table 4-6 Receiver Monitoring Capabilities of Generated Output

4-6-2 SIGNAL GENERATOR OPERATION (SIMPLEX)

1. Position front panel controls as indicated in Table 4-5.

**NOTE**

FM/AM-1200 is now generating a carrier signal at a frequency and output level of 150.2 MHz @ 500 µV.

If a signal greater than 100 mW is applied to the T/R Connector (11) while the FM/AM-1200 is generating, the set will automatically switch to the receive mode and only monitor the signal(s) applied to this connector.

4-6-3 GENERATING AM OR FM MODULATED RF SIGNALS

1. Perform "STEPS IN SIGNAL GENERATOR OPERATION" (Ref. paragraph 4-6-2).

2. Apply FM modulation signal to carrier as follows:

   a. Using Keyboard (18), depress "TONE" Key and enter desired modulation frequency and wave shape.

b. Select "INTL" with VAR Tone Selector Switch (5) and adjust VAR Tone Level Control (6) for 5 kHz as displayed on MODULATION Meter (1) and Scope Display (31).

c. If 1 kHz Tone Generator output is preferred, select "INTL" with 1 kHz Tone Selector Switch and adjust 1 kHz Tone Level Control (8) for 5 kHz as displayed on MODULATION Meter (1) and Scope Display (31).

**NOTE**

If both tone generators are used as modulation sources, the MODULATION Meter (1) and CRT Display (31) will display the composite modulation signal produced by both tone generators. To monitor either individual modulation signal, one generator must be turned off.

d. The FM/AM-1200 is now generating a carrier signal with 5 kHz FM deviation. Use monitoring features outlined in Table 4-6 to monitor desired signal parameters.

**NOTE**

For AM modulation, place MODULATION Select Control (3) to "AM NORM" position. Adjust either the 1 kHz or VAR Tone Level Controls for proper percent modulation as viewed on MODULATION Meter (1) and Scope Display (31).

4-6-4 EXTERNALLY MODULATING RF SIGNAL GENERATOR

1. Perform steps in "SIGNAL GENERATOR OPERATION".

2. Apply external modulation signal to EXT MOD/SINAD Connector (15).

**NOTE**

Insure VAR Tone Selector Switch (5) and 1 kHz Tone Selector Switch (7) are positioned to "OFF".

3. Adjust output of applied modulation signal to desired modulation level, as reflected on MODULATION Meter (1) and Scope Display (31).

4-6-5 VOICE MODULATING RF SIGNAL GENERATOR

1. Perform steps in "SIGNAL GENERATOR OPERATION".

2. Connect external microphone to MIC/ACC Connector (19).

3. Press PTT (Press-To-Talk) Switch (on microphone) and speak into microphone. Use monitoring features outlined in Table 4-6 to monitor voice modulation characteristics.

**NOTE**

Diode speech limiting is incorporated within FM/AM-1200 circuitry for control of peak modulation. The limiter is set for 6 kHz deviation.

Whenever microphone is keyed, the FM/AM-1200 will automatically switch to the generate mode of operation, if the MODE Selector Control (39) is in the "REC" or "DUP" position. The generate mode cannot be overridden by applying power transmission at the T/R Connector (11).

## 4-6-6 VARIABLE GENERATE

This feature allows the generator to be moved off center frequency a minimum of ±10 kHz and the EXT MOD Connector (15) to be used for DC coupling.

1. Set front panel controls to the positions listed in Table 4-5.
2. Position HORIZONTAL Sweep Selector Control (26) to "10kHz/ Div" and center display using HORIZ POS Control (30).
3. Rotate GEN/LOCK Control (32) out of the "LOCK" (detent) position and observe generator frequency change on analyzer display (31) and FREQ ERROR Meter (36).
4. Place GEN/LOCK Control (32) to "LOCK" (detent) and observe FREQ ERROR Meter (36) zeros and Analyzer Display (31) is centered.

## 4-6-7 MEASURING UUT RECEIVER SINAD SENSITIVITY

1. Connect 50Ω coaxial cable between FM/AM-1200 T/R Connector (11) and RF input of receiver under test.

**NOTE**

For UUT SINAD measurements, the FM/AM-1200 internal tone generator (fixed) should be used as a modulation source. A modulation frequency of 1000.0 Hz is required.

2. Connect audio output of receiver under test to EXT/MOD/SINAD Connector (15) and place Modulation METER Control (4) to "SINAD" position.

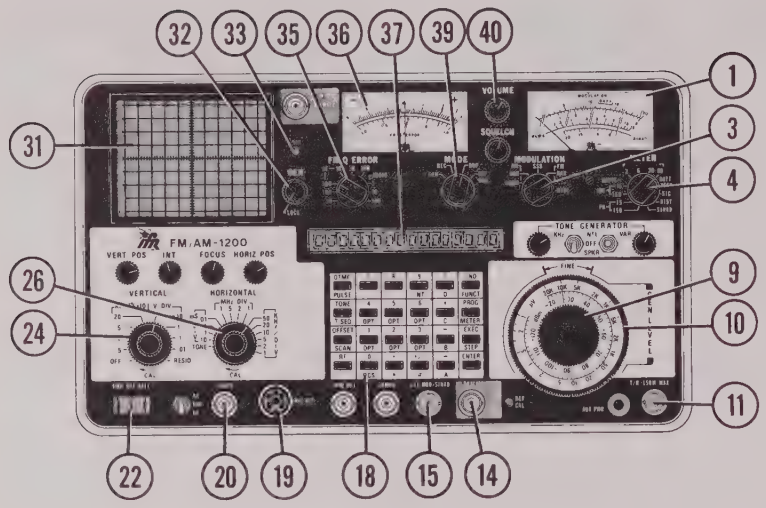
3. Adjust RF Level Attenuator Control (9) for an output level of 500 µV.

4. Slowly decrease FM/AM-1200 RF output level until MODULATION Meter (1) displays desired SINAD value.

**NOTE**

The setting of RF Level Attenuator Control (9) and RF Level Attenuator Vernier Control (10) represents SINAD sensitivity of receiver under test.

## 4-7 DUPLEX OPERATION




FM/AM-1200 CONNECTORS AND INDICATORS APPLICABLE TO DUPLEX OPERATION:

1 MODULATION Meter
11 T/R Connector
14 DUPLEX Output Connector
15 EXT MOD/SINAD Connector
19 MIC/ACC Connector
20 SCOPE Connector
31 CRT Display
33 LOCK Lamp
36 FREQ ERROR Meter
37 VFD

Figure 4-3 FM/AM-1200 Front Panel Controls Applicable to Duplex Operation

| | CONTROL | SETTING |
|---|---|---|
| 3 | MODULATION Select Control | "FM NAR" |
| 4 | Modulation METER Control | "kHz/%X10 position 6" |
| 9 | RF Level Attenuator Control | "-50 dBm" |
| 10 | RF Level Attenuator Vernier Control | -50 dBm |
| 18 | Keyboard | "RF Frequency 150.2000 MHz" |
| 22 | PWR/OFF/BATT Switch | "PWR" or "BATT" |
| 24 | VERTICAL Attenuator Selector Control | "2 kHz/%X10" |
| 26 | HORIZONTAL Sweep Selector Control | "1 mS/Div |
| 32 | GEN/LOCK Control | "LOCK" |
| 35 | FREQ ERROR Meter Range Selector Control | "10K" |
| 39 | MODE Selector Control | "GEN" |
| 40 | VOLUME Control | As req'd |

Table 4-7 FM/AM-1200 Front Panel Controls Applicable to Duplex Operation

## 4-7-1 GENERAL

In the duplex mode of operation, the FM/AM-1200 has the capability of generating and receiving signals simultaneously. While the FM/AM-1200 receiver is monitoring the power, modulation and frequency characteristics of the UUT transmitter, the FM/AM-1200 offset generator is simultaneously transmitting to the UUT receiver with a signal at a fixed output level. This signal is not affected by the operation of the UUT transmitter. FM/AM-1200 duplexer accuracy (setting up on desired frequency) is ±1.3 kHz

**NOTE**

The FM/AM-1200 contains a duplex system which is FM modulated only.

Perform the procedure in paragraph 4-6-3 "GENERATING FM MODULATED SIGNALS" before continuing on with this procedure.

Three methods of UUT duplex testing are possible, using the FM/AM-1200. They are:

## 4-7-2 DUPLEX TESTING USING SEPARATE TRANSMIT/RECEIVE LINES (FULL DUPLEX OPERATION)

In this mode, the UUT transmitter output is applied to the FM/AM-1200 at the T/R Connector (11). The FM/AM-1200 offset generator output (available at the DUPLEX Output Connector (14)), at a fixed level, is applied to the RF input of the UUT receiver.

**CAUTION**

DO NOT TRANSMIT INTO DUPLEX OUTPUT CONNECTOR (14), AS CONNECTOR IS NOT PROTECTED AGAINST RF INPUTS ABOVE 0.25 WATTS.

## 4-7-3 "OFF-THE-AIR" DUPLEX TESTING

In this mode, the output of the UUT transmitter is monitored "off-the-air" at the FM/AM-1200 ANT Connector (34), while the FM/AM-1200 offset generator output (available at the Duplex Output Connector (14) or T/R Connector (11)) is applied to the UUT receiver input.

**CAUTION**

DO NOT TRANSMIT INTO ANTENNA CONNECTOR (34); RF INPUTS IN EXCESS OF 0.25 WATTS MAY CAUSE DAMAGE TO FM/AM-1200.

## 4-7-4 DUPLEX TESTING USING COMMON TRANSMIT/RECEIVE LINE (HALF DUPLEX OPERATION)

When testing a duplex transceiver with a single transmit/receive I/O port, a common receive/transmit line is connected between the UUT RF I/O port and the FM/AM-1200 T/R Connector (11).

**CAUTION**

DO NOT TRANSMIT INTO DUPLEX OUTPUT CONNECTOR (14), AS CONNECTOR IS NOT PROTECTED AGAINST RF INPUTS ABOVE 0.25 WATTS.

**NOTE**

The offset transmitted out DUPLEX Output Connector (14) is a fixed -60 dB level.

The offset transmitted out T/R Connector (11) is a fixed -80 dB level.

The RF frequency entered in the FM/AM-1200 is the UUT transmit frequency. OFFSET = UUT receive frequency minus UUT transmit frequency. (OFFSET can be (-) negative.)

## 4-7-5 DUPLEX TESTING

Place MODE Selector control to "DUP" Position.

EXAMPLE: Testing a Duplex transceiver
UUT XMT FREQ = 157.77 MHz
UUT REC FREQ = 152.51 MHz

ENTER:

(UUT XMT Freq)

**NOTE**

OFFSET = 152.51 MHz (UUT Rec Freq) - 157.77 MHz (UUT XMT Freq) (OFFSET = -5.26 MHz)

ENTER:


**NOTE**

Use

Key until (-) sign appears in front of offset frequency.

**NOTE**

A generated RF frequency of 152.51 MHz with 5 kHz deviation @ -60 dBm is present at DUPLEX Output Connector (14). T/R Connector (11) is set to receive an RF frequency of 157.77 MHz. A signal of 152.51 MHz with 5 kHz deviation @ -80 dBm is also present at the T/R Connector (11).

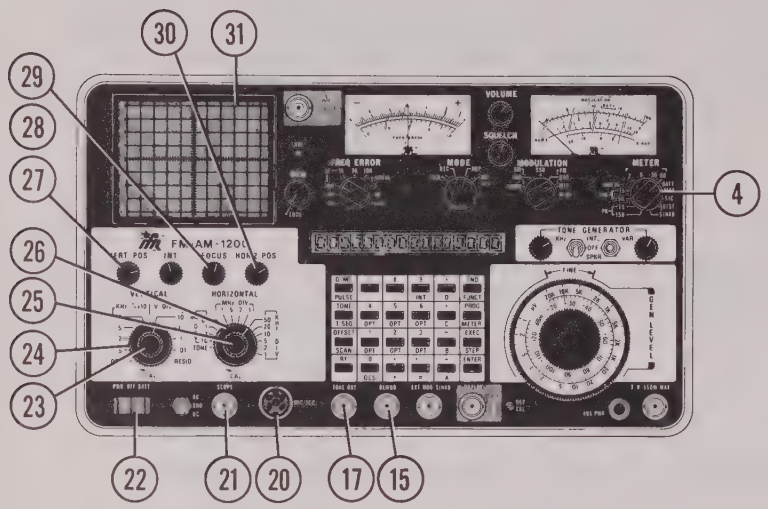
### 4-7-6 DUPLEX GENERATE MODE

In Duplex Generate Mode of operation, the signal is present at the T/R Connector (11) only. There is NO signal present at the DUPLEX Output Connector (14). The output frequency at the T/R Connector (11) is the RF setting plus the OFFSET frequency with the output level controlled by the RF Level attenuator control (9) and RF Level Attenuator Vernier Control (10). The FM/AM-1200 receiver will monitor the FM/AM-1200 generator.

**NOTE**

FM/AM-1200 is forced into the generate mode and will not switch to receive mode when transmitting into T/R Connector (11).

EXAMPLE: RF Setting = 157.77 MHz
OFFSET Setting = -5.26 MHz
Output Frequency @ T/R Connector (11) = 152.51 MHz




FM/AM-1200 CONNECTORS AND INDICATORS APPLICABLE TO OSCILLOSCOPE OPERATION:

15 EXT MOD/SINAD Connector
17 TONE OUT Connector
20 SCOPE Connector
31 CRT Display

Figure 4-4 FM/AM-1200 Front Panel Controls Applicable to Oscilloscope Operation

| | CONTROL | SETTING |
|---|---|---|
| 4 | MODULATION Meter Control | As req'd |
| 1 | AC/GND/DC Switch | As req'd |
| 2 | PWR/OFF/BATT Switch | "PWR" or "BATT" |
| 3 | VERTICAL Attenuator Vernier Control | "CAL" |
| 4 | VERTICAL Attenuator Selector Control | "1 V/Div" As req'd |
| 5 | HORIZONTAL Sweep Vernier Control | "CAL" |
| 6 | HORIZONTAL Sweep Selector Control | "1 mS/Div" |
| 7 | VERT POS Control | Ctr Trace |
| 8 | INT Control | As req'd |
| 9 | FOCUS Control | As req'd |
| 0 | HORIZ POS Control | Ctr Trace |

Table 4-8 FM/AM-1200 Front Panel Controls Applicable to Oscilloscope Operation

## 4-8-1 GENERAL

Table 4-8 lists the front panel controls which are used in the Oscilloscope function of the FM/AM-1200. For oscilloscope operation, the HORIZONTAL Sweep Selector Control (25) must be in "mS/Div" Position. The VERTICAL Attenuator Selector Control (24) "kHz/%X10" position is for internal demodulated audio and "V/Div" position is for external scope inputs. All other controls are similar to those found on most conventional oscilloscopes.

## 4-8-2 External Oscilloscope Operation

The FM/AM-1200 Oscilloscope is a general purpose DC to 1 MHz bandwidth single trace oscilloscope with automatic triggering. Any external input to the scope must be applied at the front panel SCOPE Connector (20).

1. Place the FM/AM-1200 front panel controls to the settings listed in Table 4-8.
2. Connect TONE OUT Connector (17) to SCOPE Connector (20).
3. Turn 1 kHz TONE Selector Switch (7) to "INTL" Position.
4. Adjust 1 kHz TONE LEVEL Control (8) for a viewed sine wave on CRT Display (31).

**NOTE**

When AC/GND/DC Switch (21) is in "GND" Position, the external input is removed from the Oscilloscope.

## 4-8-3 Internal Oscilloscope Operation

The VERTICAL Attenuator Selector Control (24) must be in one of the four kHz/%X10 Positions for internal oscilloscope operation.

1. Place the FM/AM-1200 front panel controls to the settings listed in Table 4-8.
2. Set Vertical Attenuator Selector Control (24) to "2 kHz/%X10" Position.
3. Set FM/AM-1200 controls for 5 kHz FM deviation. (Ref. paragraph 4-6, RF Signal Generation Operation (Simplex).)
4. The CRT now displays (+) and (-) 5 kHz deviation.

**NOTE**

For AM modulation, the demodulated audio displayed on CRT will read twice the percentage of modulation.

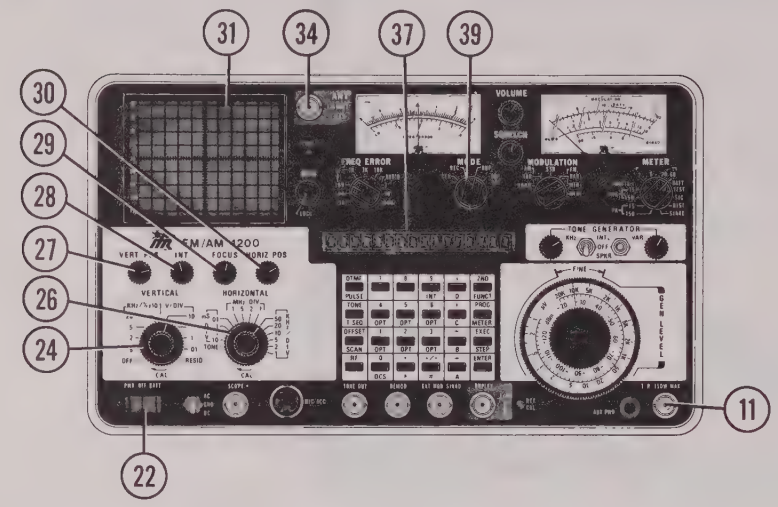
### 4-8-4 Residual Distortion

The "RESID" position of the VERTICAL Attenuator Selector Control (24) allows the display of the residual distortion or noise of the UUT, as received at the EXT MOD/SINAD Connector (15). The "RESID" position is only valid when the Modulation METER Control (4) is in "SINAD" or "DIST" position.

### 4-8-5 Tone Generator

The "TONE" position of the HORIZONTAL Sweep Selector Control (26) applies the output of the Programmable and/or Fixed (1 kHz) Tone Generators to the horizontal deflection circuits of the CRT. This function is useful for measuring the frequency of demodulated audio or externally applied audio signals, using the Lissajou method of frequency comparison.

## 4-9 SPECTRUM ANALYZER OPERATION




FM/AM-1200 CONNECTORS AND INDICATORS APPLICABLE TO SPECTRUM ANALYZER OPERATION:

11 T/R Connector
31 CRT Display
34 ANT Connector
37 VFD

Figure 4-5 FM/AM-1200 Front Panel Controls Applicable to Spectrum Analyzer Operation

| | CONTROL | SETTING |
|---|---|---|
| 18 | Keyboard | As req'd |
| 22 | PWR/OFF/BATT Switch | "PWR" or "BATT" |
| 24 | VERTICAL Attenuator Selector Control | Any position except "OFF" |
| 26 | HORIZONTAL Sweep Selector Control | "1 MHz/Div |
| 27 | VERT POS Control | "Mid Range" |
| 28 | INT Control | As req'd |
| 29 | FOCUS Control | As req'd |
| 30 | HORIZ POS Control | "Mid Range" |
| 39 | MODE Selector Control | As req'd |

Table 4-9 FM/AM-1200 Front Panel Controls Applicable to Spectrum Analyzer Operation

### 4-9-1 GENERAL

Table 4-9 lists the FM/AM-1200 front panel controls applicable to the Spectrum Analyzer function. The FM/AM-1200 Spectrum Analyzer is a general purpose analyzer capable of monitoring RF signals within a range of 250 kHz to 999.9999 MHz. The HORIZONTAL Sweep Selector Control (26) must be in either one of the MHz/Div or kHz/Div positions for spectrum analyzer operation. The RF frequency displayed on VFD (37) is the spectrum analyzer center frequency. The spectrum analyzer bandwidth is automatically selected.

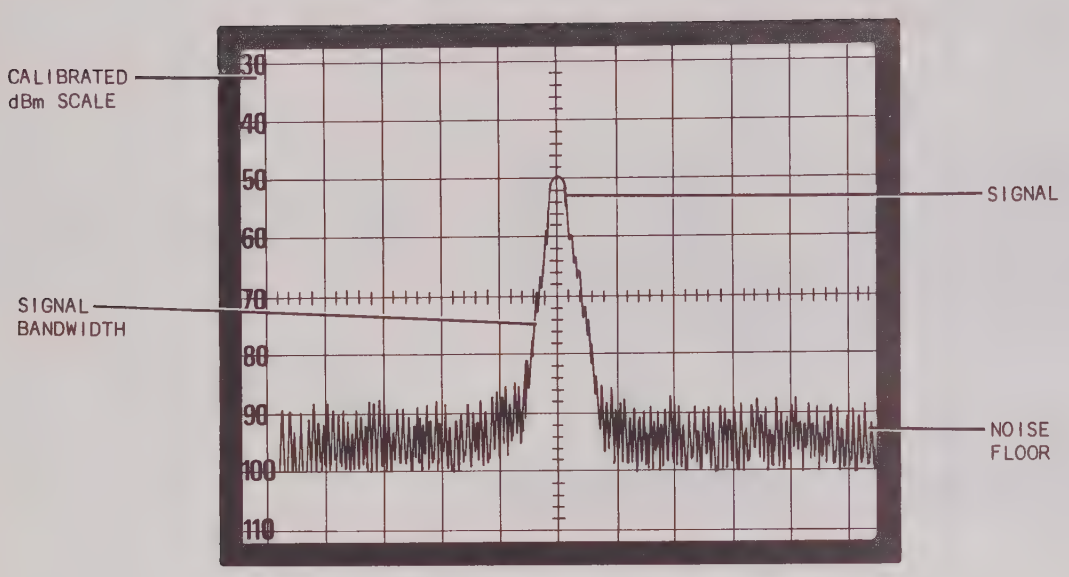



Figure 4-6 Typical Spectrum Analyzer Display

VERT POS Control (27)

Controls Spectrum Analyzer vertical position and allows adjustment of reference level by one scale division over range of vertical axis.

HORIZ POS Control (30)

Controls horizontal position of Spectrum Analyzer and limits this control to one division left or right.

HORIZONTAL Sweep Selector Control (26)

| HORIZONTAL/DISPERSION | BANDWIDTH |
|---|---|
| 1 kHz/DIV | 300 Hz |
| 2 kHz/DIV | 300 Hz |
| 5 kHz/DIV | 3 kHz |
| 10 kHz/DIV | 3 kHz |
| 20 kHz/DIV | 3 kHz |
| 50 kHz/DIV | 30 kHz |
| .1 MHz/DIV | 30 kHz |
| .2 MHz/DIV | 30 kHz |
| .5 MHz/DIV | 30 kHz |
| 1 MHz/DIV | 30 kHz |

Table 4-10 Horizontal Sweep Selector Control (Analyzer Dispersion Control) Settings

4-9-2 Spectrum Analyzer Operation

To calibrate analyzer base line, perform the following steps:

1. Place the FM/AM-1200 front panel controls to the settings listed in Table 4-9.

2. Set HORIZONTAL Sweep Selector Control (26) to any mS/Div Position.

3. Adjust VERT POS Control (27) to center trace directly over center horizontal graticule.

4. Set HORIZONTAL Sweep Selector Control (26) to "1 MHz/Div" Position and MODE Selector Control (39) to "GEN" Position.

5. Adjust HORIZ POS Control (30) to center signal directly over center vertical graticule.

With the spectrum analyzer baseline calibrated, a -30 dBm RF signal applied to ANT Connector (34) will indicate a full scale display.

## 4-10 TONE GENERATOR OPERATION

The FM/AM-1200 has two independently controlled tone generators (one variable and one fixed). The variable tone generator is capable of generating modulation sinewave signals within a range of 2 Hz to 30 kHz (in 0.1 Hz increments). All other waveform modulation signals are within a range of 2 Hz to 10 kHz (in 0.1 Hz increments). The fixed tone generator output is a 1 kHz sinewave. The frequency and wave shape of the variable tone generator is selected by the FM/AM-1200 Keyboard (18) and displayed on the VFD (37) when the Keyboard "TONE" key mode is selected. The output level of each tone generator can be individually controlled.

## 4-11 BASIC RS-232 OPERATION

This paragraph contains basic instructions for operating the FM/AM-1200 using an RS-232 compatible external device. Using these instructions, the operator can select any available parameter of the following FM/AM-1200 functions:

| | | | |
|---|---|---|---|
| DTMF | OFFSET | PULSE | METER |
| TONE | RF | TONE WAVEFORM | DCS |

### 4-11-1 FM/AM-1200 INITIALIZATION

The initial communication between the FM/AM-1200 and the external controlling device consists of automatic Baud Rate synchronization. To comply automatically, the external controlling device must be set at one of the following Baud Rates:

| | | |
|---|---|---|
| 1200 | 4800 | 19.2 K |
| 600 | 2400 | 9600 |

Use the following procedure to initialize FM/AM-1200 for external control (RS-232 operation):

STEP PROCEDURE

1. Connect external controlling device to FM/AM-1200 at RS-232 Connector (42). (Refer to appropriate Pin-out Table in Appendix B).

2. Check FM/AM-1200 Protocol (Appendix B).

3. Type one (1) "M" (using external device keyboard). This action will allow FM/AM-1200 processor to set its Baud Rate to that of the external controlling device.

4. Type another "M" and observe FM-AM-1200 VFD (37). "BAUD RATE SET" should be displayed. This indicates that the Baud Rate of the FM/AM-1200 is set to the Baud Rate of the external device.

**NOTE**

If FM/AM-1200 VFD (37) displays anything other than "BAUD RATE SET", check and verify RS-232 interface connection and Protocol, re-accomplish procedure beginning with Step 3.

4-11-2 RS-232 LOCAL COMMANDS

The FM/AM-1200 functions, their RS-232 command equivalents and the command value field presently available for each during RS-232 communication, are listed in Table 4-11.

| FM/AM-1200 FUNCTION | RS-232 COMMAND | COMMAND VALUE FIELD |
|---|---|---|
| DTMF | DTM or DTMF | Up to 16 characters consisting of any of of the following: Ø thru 9, A, B, C, D, # or * |
| TONE | AFF | ØØØØØ.Ø to 99999.9 |
| TONE WAVEFORM | WAV | Sets the TONE WAVEFORM as follows:<br>SIN = SINE<br>SQU = SQUARE<br>RMP = RAMP<br>TRI = TRIANGLE<br>Example: Enter WAV3 = SIN<br>Sets the 4th preset tone waveform to a sine wave. |
| OFFSET | DPX | -49.99 to +49.99 (any value above 49.99 will default to 4X.XX)<br>Example: Enter DPX=65.55<br>FM/AM-1200 will assume 45.55. |
| RF | RFF | ØØØ.ØØØØ to 999.9999<br>(After the last character of the value field has been selected, any subsequent numerical character selection will assume the last character position of the value field.) |
| PULSE | PUL, PULS or PULSE | Up to 16 characters consisting of any of the following: Ø thru 9, A, B, C, D, # or * |
| METER | MTR1 | Places FM/AM-1200 in the Meter mode and returns the current value of the FREQ ERROR Meter.* |
| | MTR2 | Places FM/AM-1200 in the Meter mode and returns the current value of the MODULATION Meter.* |

* Value of returned meter reading is determined by position of Modulation METER Control (4) or FREQ ERROR Meter Range Selector Control (35).

Table 4-11 Function, Command and Value Fields

Table 4-11 (Cont'd)

| FM/AM-1200 FUNCTION | RS-232 COMMAND | COMMAND VALUE FIELD |
|---|---|---|
| DCS | DCS? | Returns preprogrammed value. |
| | DCS= | Places FM/AM-1200 in the DCS mode and allows input of new DCS value. |
| RS-232 | ! | Allows up to 16 ASCII characters to be displayed on VFD (37).<br>**NOTE**<br>This command will not operate properly if a function that updates the VFD (37) is operating, such as METER, T SEQ, SCAN, etc. |

* Value of returned meter reading is determined by position of Modulation METER Control (4) or FREQ ERROR Meter Range Selector Control (35).

Table 4-11 Function, Command and Value Fields

4-11-3 ALLOWABLE COMMAND FORMATS

FM/AM-1200 communication with an external controlling device requires use of the allowable RS-232 Command formats listed in Table 4-12.

| COMMAND | DEFINITION | EXAMPLE |
|---|---|---|
| FUNC=VALUE (CR or Colon)* | Sets preset Ø (1st preset) of selected function (see Table 4-11, RS-232 Command Column) to value selected (see Table 4-11, Command Value Field Column) and executes it. | AFF=12345.6 Sets TONE preset Ø position to 12345.6 Hz and executes it. |

* FUNC = AFF, DPX, DCS, DTM, DTMF, MTR1, MTR2, PUL, PULS, PULSE, RFF or WAV as listed in Table 4-11.
(nn) = function preset number (Ø thru 15).
Linefeed, Carriage Return or Colon = terminates command.
Value = function command value field.

Table 4-12 Allowable RS-232 Command Formats

Table 4-12 (Cont'd)

| COMMAND | DEFINITION | EXAMPLE |
|---|---|---|
| FUNC(nn)=VALUE* | Programs preset number selected (Ø thru 15) of function selected (see Table 4-11, RS-232 Command Column) to value selected (see Table 4-11, Command Value Field Column). Does not execute selection. | RFF6=345.6666 Programs RF preset 7 to 345.6666 MHz. |
| FUNC (CR or Colon)* | Executes the 1st preset position of function selected. | DTMF: Executes the value of the 1st preset DTMF position. |
| FUNC (nn) (CR or Colon)* | Executes the selected preset position (Ø thru 15) of the selected function (see Table 4-11, RS-232 Command Column). | PULSE 12: Executes the value of the 13th preset position of the PULSE function. |
| FUNC (nn)?* | Returns the value of the selected preset position (Ø thru 15) of the selected function (see Table 4-11, RS-232 Command Column). | RFF2? Returns the present value of the 3rd preset RF position.<br><br>AFF(nn)? Returns frequency of Tone position (nn).<br><br>WAV(nn)? Returns waveform of Tone position (nn). |

* FUNC = AFF, DPX, DCS, DTM, DTMF, MTR, PUL, PULS, PULSE, RFF or WAV as listed in Table 4-11.
(nn) = function preset number (Ø thru 15).
Linefeed, Carriage Return or Colon = terminates command.
Value = function command value field.

Table 4-12 Allowable RS-232 Command Formats

4-11-4 RS-232 REMOTE COMMANDS

In the remote mode, the following commands override the FM/AM-1200 front panel controls and switches. RS-232 remote commands are listed in Table 4-13.

| RS-232 REMOTE COMMANDS | DEFINITION |
|---|---|
| 1. REM | Puts the 1200 in the remote mode allowing external control of the front panel switches. |
| 2. LOC | Disables remote mode. Returns control of the switches to the front panel. |
| 3. GEN | Place in generate. |
| 4. REC | Place in receive. |
| 5. DUP | Place in duplex. |
| 6. DPG | Place in duplex generate. |
| 8. RFE1 | Sets the frequency error meter in range 1. (30 Hz RF) |
| 9. RFE2 | Sets the frequency error meter in range 2. (100 Hz RF) |
| 10. RFE3 | Sets the frequency error meter in range 3. (300 Hz RF) |
| 11. RFE4 | Sets the frequency error meter in range 4. (1000 Hz RF) |
| 12. RFE5 | Set the frequency error meter in range 5. (3000 Hz RF) |
| 13. RFE6 | Sets the frequency error meter in range 6. (10 kHz RF) |
| 14. AFE1 | Sets the frequency error meter in range 7. (3 Hz audio) |
| 15. AFE2 | Sets the frequency error meter in range 8. (30 Hz audio) |
| 16. AFE3 | Sets the frequency error meter in range 9. (300 Hz audio) |
| 22. R2 | Enables the modulation meter to measure modulation on the 2 KHz F.S. or 20% F.S. depending upon the mode of modulation (FM or AM). |

Table 4-13 RS-232 Remote Commands

Table 4-13 (Cont'd)

| RS232 REMOTE COMMANDS | DEFINITION |
|---|---|
| 23. R6 | Enables the modulation meter to measure modulation on the 6 kHz F.S. or 60% F.S. depending upon the mode of modulation (FM or AM). |
| 24. R20 | Enables the modulation meter to measure modulation on the 20 kHz F.S. or 200% F.S. depending upon the mode of modulation (FM or AM). |
| 25. R60 | Enables the modulation meter to measure modulation on the 60 kHz F.S. or 600% F.S. depending upon the mode of modulation (FM or AM). |
| 26. 15A | Enables the modulation meter to measure average power on the 15 watt F.S. |
| 27. 150A | Enables the modulation meter to measure average power on the 150 watt F.S. |
| 28. 15P | Enables the modulation meter to measure peak power on the 15 watt F.S. |
| 29. 150P | Enables the modulation meter to measure peak power on the 150 watt F.S. |
| 30. SIG | Enables the modulation meter to measure signal strength. |
| 31. DIS | Enables the modulation meter to measure signal distortion. |
| 32. SID | Enables the modulation meter to measure SINAD. |
| 33. BAT | Enables the modulation meter to measure battery voltage. |

Table 4-13 RS-232 Remote Commands

# SECTION 5 - MINIMUM PERFORMANCE CHECK

## 5-1 GENERAL

This section contains a quick, qualitative, step-by-step check for assessing the performance of the FM/AM-1200. This check should be used when the operating condition of the set is in question. The check contained in this section is performed using the FM/AM-1200 front panel controls and do not require the removal of the exterior case. This check can be performed within 4 to 6 minutes, while the set is operating on its own internal battery power. Only a two foot length of 50Ω coaxial cable (with BNC connectors on each end) is required as accessory equipment to perform this check.

**NOTE**

If a determination is made that the FM/AM-1200 is not performing properly as a result of this performance check, the operator/technician should perform a thorough laboratory or bench check before taking any corrective maintenance action.

### 5-1-1 PRECHECK CONSIDERATIONS

For maximum benefit of the performance check, it is strongly recommended that personnel:

1. Thoroughly read and understand all steps of the check prior to actual initiation.

2. Be familiar with the FM/AM-1200 front and rear panel controls, indicators and connectors, as described in Section 3 of this manual. The performance check assumes the operator/technician is familiar with the set.

## 5-2 MINIMUM PERFORMANCE CHECK

SPECIAL ACCESSORY EQUIPMENT REQ'D: One 2-foot length of 50Ω coaxial cable w/BNC connectors on each end.

TEST SET-UP DIAGRAM:

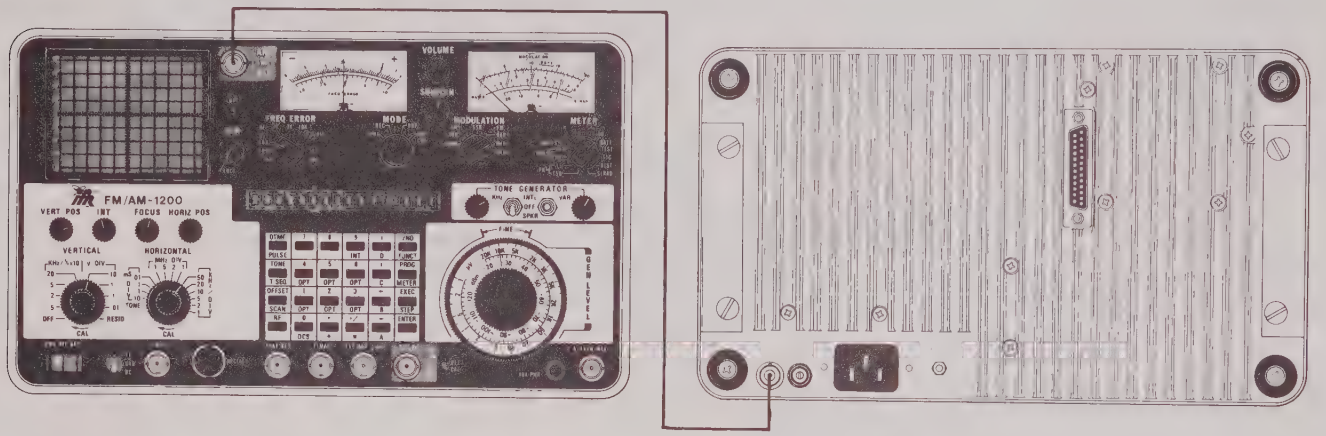



Figure 5-1 Performance Test Set-Up Diagram

| | CONTROL | INITIAL SETTING |
|---|---|---|
| 3 | MODULATION Select Control | "AM" - "NORMAL" |
| 4 | Modulation METER Control | "BATT TEST" |
| 5 | VAR Tone Selector Switch | "OFF" |
| 6 | VAR Tone Level Control | full ccw |
| 7 | 1 kHz Tone Selector Switch | "OFF" |
| 8 | 1 kHz Tone Level Control | full ccw |
| 10 | RF Level Attenuator Vernier Control | full ccw |
| 21 | AC/GND/DC Switch | "GND" |
| 22 | PWR/OFF/ BATT Switch | "OFF" |
| 23 | VERTICAL Attenuator Selector Control | "OFF" |
| 32 | GEN/LOCK Control | "LOCK" |
| 35 | FREQ ERROR Meter Range Selector Control | "10K" |
| 39 | MODE Selector Control | "REC" |

Table 5-1 Initial Control Settings

STEP PROCEDURE

1. Set FM/AM-1200 controls to initial settings described in Table 5-1.

2. Connect 2-foot length of 50Ω coaxial cable between ANT Connector (34) and External Reference Connector (45) as shown in Figure 5-1.

3. Place PWR/OFF/BATT Switch (22) to either "PWR" or "BATT" position and observe the following indications:

| STEP | PROCEDURE |
|---|---|

3. (Cont'd)

   a. "IFR's FM/AM-1200" illuminated on VFD (37) for approximately two seconds, followed by "VERSION X.X.X. XX.XX", before the RF function appears.

**NOTE**

CHECKSUM ERROR followed by MEMORY RESET displayed on VFD (37), in place of the sequence described above, indicates the pre-programmed data may have been lost.

**NOTE**

If the PWR/OFF/BATT Switch (22) was placed to the "BATT" position, place Modulation METER Control (4) to the "BATT TEST" position and verify MODULATION Meter (1) indicates within the BATT range.

If using internal battery power and external AC or DC power is available, place PWR/OFF/BATT Switch (22) to "PWR" position before continuing.

   b. Steady illumination of generator LOCK Lamp (33).

**NOTE**

If LOCK Lamp (33) is flashing, check position of GEN/LOCK Control (32) to be as indicated in Table 5-1.

If LOCK Lamp (33) is steady, rotate GEN/LOCK Control (32) out of "LOCK" position and verify LOCK Lamp (33) flashes.

4. Using Keyboard (18), select 10 MHz (RF function).

5. Place VERTICAL Attenuator Selector Control (24) to any position except "OFF".

6. Place HORIZONTAL Sweep Selector Control (26) to desired position in Spectrum Analyzer range to observe 10 MHz.

7. Place Modulation METER Control (4) to "SIG" position and observe signal strength (relative deflection of meter).

| STEP | PROCEDURE |
|---|---|
| 8. | Verify FREQ ERROR Meter (36) is centered. |
| 9. | Place FREQ ERROR Meter Range Selector Control (35) to the RF "1K" position. |
| 10. | Using Keyboard (18), slew last charcter of RF function up and down 5 units and verify deflection on FREQ ERROR Meter (36). |

RECEIVING WWV TIME STANDARD TO CALIBRATE FM/AM-1200 MASTER OSCILLATOR (Off-The-Air)

1. Connect BNC Tee Connector to ANT Connector (34).
2. Connect antenna to one side of Tee Connector.
3. Connect 2 foot length 50Ω coax cable between the External Reference Connector (45) to other end of BNC Tee Connector.

**NOTE**

Loosely connect coax cable to BNC Tee Connector, so as not to swamp out the received WWV signal.

4. Adjust REF CAL Adjustment (13) on FM/AM-1200 front panel to obtain a suitable beat note (zero beat) from the FM/AM-1200 speaker.

# APPENDICES

## APPENDIX A - FM/AM-1200 SPECIFICATIONS

### A-1 RF SIGNAL GENERATOR

| | |
|---|---|
| Frequency Range: | 250 kHz to 999.9999 MHz in 100 Hz increments. |
| Frequency Accuracy: | (Same as Master Oscillator) |
| Residual FM: | <100 Hz RMS peak |
| Post Detection: | (300 Hz to 3 kHz Bandwidth) |
| RF Output Power: | -127 dBm to -20 dBm (10 dB steps with 11 dB range vernier into 50 Ohms). |
| RF Output Accuracy: | ±2.5 dB |
| Variable Generate: | When in the "locked" position, the generator is phase-locked to the master oscillator. When switched from the "locked" position, the generator may be varied ±10 kHz. |
| Internal Modulation: | (See Function Generator) |
| External Modulation: | |
| Frequency Response: | FM: 2 Hz to 30 kHz (DC when in variable generate).<br>AM: 10 Hz to 10 kHz (30% maximum modulation above 5 kHz). |
| Modulation Sensitivity: | FM: 0.08 VRMS/kHz<br>AM: 0.01 VRMS/% |
| Distortion: | FM: <1% to 20 kHz deviation<br>AM: <10% to 60% modulation |
| Input Impedance: | Greater than 10 K Ohms. |
| Microphone Input: | Generator can be switched on by an external microphone. FM/AM-1200 has internal pre-amp with speech limiting. |

### A-2 DUPLEX GENERATOR

| | |
|---|---|
| Frequency Range: | ±49.99 MHz from receive frequency in 10 kHz steps. |
| Frequency Resolution: | 2.5 kHz |
| Frequency Accuracy: | (See Master Oscillator) |
| Output Level: | |
| Duplex Port: | -55 dBm ±5 dB fixed level |
| Input Protection: | 0.25 WATT (maximum without damage) |
| Transmission Port: | -80 dBm ±5 dB fixed level |

## A-3 RECEIVE/MONITOR

Frequency Range: 100 kHz to 999.9999 MHz in 100 Hz increments.

Sensitivity: 2 μV (1 MHz to 1000 MHz, FM narrow).

Selectivity (at 3 dB):

| MODE | RECEIVER BANDWIDTH | AUDIO BANDWIDTH |
|---|---|---|
| FM WIDE | 200 kHz | 80 kHz |
| FM MID | 200 kHz | 8 kHz |
| FM NAR | 15 kHz | 8 kHz |
| SSB | 6 kHz | 8 kHz |
| AM NAR | 6 kHz | 8 kHz |
| AM NORM | 15 kHz | 8 kHz |

Adjacent Channel Rejection:

| RECEIVER BANDWIDTH | GREATER THAN 40 dB DOWN |
|---|---|
| 200 kHz | ±300 kHz |
| 15 kHz | ±27 kHz |
| 6 kHz | ±12 kHz |

Demodulation Output:
- Impedance: 600 Ohms
- Output Level: (Into an open circuit): FM: 60 mVRMS/1 kHz (nominal) AM: 5 mVRMS/% (nominal)

Receiver Antenna:
- Input Protection: 0.25 WATT (maximum without damage)

## A-4 POWER METER

Range: 0 to 15 and 0 to 150 WATTS peak or average responding.

Accuracy: 1 to 600 MHz ±7% of reading ±3% of full scale. 600 to 1000 MHz ±20% of reading ±3% of full scale.

Input Power: 50 WATTS continuous
150 WATTS, one minute "ON", five minutes "OFF".

## A-5 FREQUENCY ERROR METER

RF Accuracy: ±Master Oscillator ±3% of full scale

RF Ranges: ±10 kHz, ±3 kHz, ±1 kHz, ±300 Hz, ±30 Hz full scale

Audio Counter:
- Frequency Range: 10 Hz to 30 kHz
- Accuracy: ±0.01% of frequency, ±6% of full scale
- Ranges: ±300 Hz, ±30 Hz, ±3 Hz full scale

## A-6 MODULATION METER

| | |
|---|---|
| Type: | Maximum of Positive or Negative Peak (AM and FM). |
| FM Deviation: | |
| Accuracy: | ±5% of reading.<br>±3% of full sale for a 1 kHz tone. |
| Ranges: | 2 kHz, 6 kHz, 20 kHz, 60 kHz full scale. |
| AM% Modulation: | |
| Accuracy: | ±5% of reading.<br>±3% of full scale for a 1 kHz tone. |
| Ranges: | 60%, 200% full scale. |
| Demodulation Output: | |
| Impedance: | 600 Ohms |
| Output Level: | (Into an open circuit):<br>FM: 60 mVRMS/1 kHz (nominal)<br>AM: 5 mVRMS/% (nominal) |
| Receiver Antenna: | |
| Input Protection: | 0.25 WATT (maximum without damage) |

## A-7 SINAD DISTORTION METER

| | |
|---|---|
| Sinad: | 3 to 20 dB at 1 kHz. |
| Accuracy: | ±1 dB at 12 dB SINAD. |
| Input Level: | 0.25 VRMS to 2 VRMS (10 VRMS maximum SINAD). |
| Impedance: | 10 K Ohm Nominal. |
| Distortion Range: | 0 to 20% at 1 kHz.<br>±1% at 10% distortion. |

## A-8 FUNCTION GENERATOR

| | |
|---|---|
| Operating Modes: | |
| Internal: | Modulation/Tone-out level controlled by fixed 1 kHz and/or variable tone control. |
| Speaker: | Tone applied directly to speaker with volume controlled by a fixed 1 kHz and/or variable tone controls. |
| External Plus Internal: | External modulation input is summed directly with tones and applied to monitor. |
| Tone Accuracy: | |
| Fixed: | (Same as Master Oscillator) |
| Variable: | ±0.01% |
| Tone Distortion: | (At 2.5 VRMS output) |
| Fixed: | ±0.5% |
| Variable (SINE): | ±2% (10 Hz to 100 Hz)<br>±0.7% TYPICAL (100 Hz to 30 kHz). Some frequencies have a measured distortion of less than 1.5% as measured on a typical null type distortion analyzer. |

## A-8 FUNCTION GENERATOR (Cont'd)

| | |
|---|---|
| Tone Output Level: | 0 to 2.5 VRMS minimum, either tone into 150 Ohm load. |
| Frequency Range: (Variable): | 10 Hz to 30 kHz in 0.1 Hz increments |
| Functions: | SINE, SQUARE, RAMP, TRIANGLE, DTMF, TONE SEQ and DCS. |

## A-9 OSCILLOSCOPE

| | |
|---|---|
| Display Size: | 2 inches X 2½ inches. |
| Vertical Bandwidth: | DC to 1 MHz (at 3 dB Bandwidth) |
| External Vertical: Input Ranges: | 10 mV, 100 mV, 1 V, 10 V, per division. |
| Horizontal Sweep: Rate: | 10 mSec, 1 mSec, 100 µSec 10 µSec per division. |

## A-10 SPECTRUM ANALYZER

Log Scale: Within ±2 dB linearity from -30 dBm to -90 dBm indication.

Dynamic Range: 70 dB (-30 dBm to -100 dBm).

Modes:

| SCAN WIDTH | BANDWIDTH |
|---|---|
| 1 MHz/DIV | 30 kHz |
| 500 kHz/DIV | 30 kHz |
| 200 kHz/DIV | 30 kHz |
| 100 kHz/DIV | 30 kHz |
| 50 kHz/DIV | 30 kHz |
| 20 kHz/DIV | 3 kHz |
| 10 kHz/DIV | 3 kHz |
| 5 kHz/DIV | 3 kHz |
| 2 kHz/DIV | 300 kHz |
| 1 kHz/DIV | 300 kHz |

The receiver is fixed on the center frequency for monitoring while the analyzer scans as specified.

## A-11 MASTER OSCILLATOR

| | |
|---|---|
| Standard TCXO: | |
| Accuracy: | 0.5 PPM (0.50° C) |
| Aging: | 3 PPM first year, 1 PPM per year, thereafter. |
| Optional TCXO: | (Option 01) |
| Accuracy: | 0.2 PPM (0-50° C) |
| Aging: | 3 PPM first year, 1 PPM per year, thereafter. |
| Optional Oven Oscillator: | (Option 02) |
| Accuracy: | 0.05 PPM (0-50° C) |
| Aging: | 1 PPM per year. |

## A-12 GENERATE AMPLIFIER (OPTIONAL)

| | |
|---|---|
| Gain: | 30 ±2 dB typical, 250 kHz to 1000 MHz |
| Test Set Output with Amplifier Installed: | Variable to +10 dBm, FM, CW<br>Variable to +4 dBm, AM |

## A-13 GENERAL CHARACTERISTICS

| | |
|---|---|
| Dimensions: | 13 1/16" wide, 7 5/16" high, 17½" deep |
| Weight: | 32 lbs. (without options) |
| Temperature Range: | 0 to 50°C |

## A-14 POWER REQUIREMENTS

| | |
|---|---|
| Line: | 105 - 130/210 - 260 VAC<br>50 - 400 Hz at 65 WATTS typical. |
| Ext. DC: | 12 - 30 VDC nominal, 4 AMPS at 12 V typical, 1.7 AMPS at 28 V typical |

# APPENDIX B - TABLE OF USER I/O PORTS/CONNECTORS PIN-OUT TABLES

## B-1 TABLES OF I/O PORTS

| CONNECTOR NAME | CONNECTOR TYPE | SIGNAL INPUT/OUTPUT | SIGNAL TYPE |
|---|---|---|---|
| T/R | BNC | Input/Output | RF |
| AUX PWR | Banana Jack | Output | +12 VDC |
| DUPLEX Output | BNC | Output | RF |
| EXT MOD/SINAD | BNC | Input/Output | Audio |
| DEMOD | BNC | Output | Audio |
| TONE OUT | BNC | Output | Audio |
| MIC/ACC | 5 Pin Microphone Connector | Input/Output | See Pin Out |
| SCOPE | BNC | Input | DC to 1 MHz |
| ANT | BNC | Input | RF |
| RS-232 | 25 Pin, Type D | Input/Output | See Pin Out |
| External Reference | BNC | Input/Output | 10 MHz RF |

## B-2 PIN OUT TABLE FOR MIC/ACC CONNECTOR

| MIC/ACC CONNECTOR PIN ASSIGNMENTS | | | |
|---|---|---|---|
| Pin No. | Signal Name | Signal Type | Input/Output |
| 1 | +12 VDC | DC Voltage | 1/8 AMP Fused Output |
| 2 | Chassis GND | | |
| 3 | Mic Key | Switched | GND for Generate |
| 4 | Mic Audio | Audio | Input |
| 5 | Tone Key | Switched | GND to Remove Variable Tone |

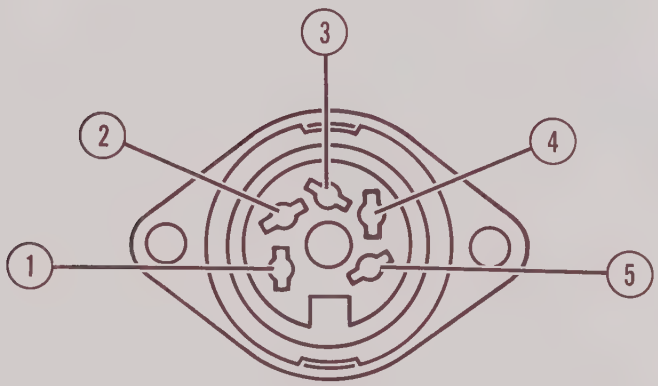



Figure B-1 MIC/ACC Connector Pin Identification (Front View)

## B-3 PIN OUT TABLE FOR RS232 CONNECTOR

RS-232 CONNECTOR PIN ASSIGNMENTS

(The FM/AM-1200 is used as a terminal.)

| Pin No. | Input/Output | Remarks |
|---|---|---|
| 2 (RXD) | ← Commands | |
| 3 (TXD) | Info → | |
| 4 (RTS) | → | If low, FM/AM-1200 can receive command. If high FM/AM-1200 is busy. |
| 5 (CTS) | ← | If low, terminal is not ready to receive. If not used, it must be tied high. |
| 7 (Common Ground) | | |
| 1, 6 and 8 thru 25 not used | | |

FM/AM-1200 PROTOCOL

No Parity

Must Be Half Duplex

Must Be Upper Case

8 Data Bits Per Character

Bit 8 Must Be Zero (Most Significant Bit)

1 Stop Bit (End Of Character)

High Level = -12V

Low Level = +12V

# APPENDIX C - OPTIONAL GENERATE AMPLIFIER (OPTION 05)

## C-1 GENERAL

The Generate Amplifier is a 30 dB amplifier intended to increase the output level of a generated signal above the normal maximum level by the service monitor. It is not designed to receive any signal directly from a Unit Under Test (UUT); however, if properly installed, it can be used to transmit and receive signals "off the air", using the antenna.

**CAUTION**

DO NOT TRANSMIT FROM A UUT DIRECTLY INTO THE GENERATE AMPLIFIER, OR THROUGH AN EXTERNAL ATTENUATOR. DAMAGE TO THE GENERATE AMPLIFIER AND/OR THE SERVICE MONITOR WILL RESULT.

## C-2 INSTALLATION

Insert the banana plug on the Generate Amplifier into the AUX PWR Jack on the Front Panel of the Service Monitor and connect the BNC connector to the T/R Jack.

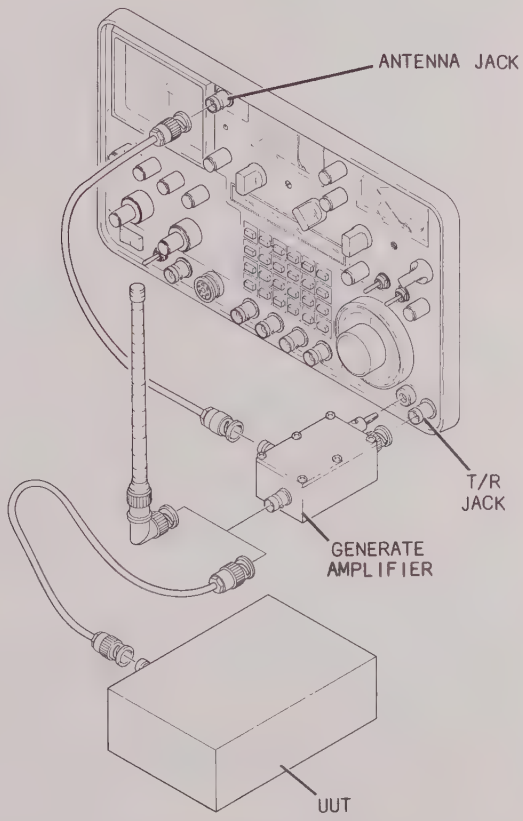
For Direct Connection To UUT:

Connect coax cable between the UUT Test Jack on the Generate Amplifier and the Microphone Jack or other audio input on the UUT.

For Radio Installation Checkout:

**WARNING**

THIS TEST MUST BE PERFORMED WITH THE SERVICE MONITOR AND UUT INSIDE A SHIELDED AREA TO PREVENT UNRESTRICTED RADIATION OF RF SIGNALS.




Connect coax between Antenna Jack on the Front Panel of the Service Monitor and the Antenna Jack on the Generate Amplifier. Connect accessory antenna to the UUT Test Jack on the Generate Amplifier.

## C-3 OPERATION

Refer to Section 4 and perform the procedures for generating and receiving RF signals.

# APPENDIX D - REPACKING FOR SHIPMENT

## D-1 SHIPPING INFORMATION

IFR test sets returned to factory for calibration, service or repair must be repackaged and shipped subject to the following conditions:

Do not return any products to factory without first receiving authorization from IFR Customer Service Department.

CONTACT: Customer Service Dept.
IFR, Inc.
10200 West York Street
Wichita, Kansas 67215

Telephone: (800)-835-2350
TWX: 910-741-6952

All test sets must be tagged with:

a. Owner's identification and address.
b. Nature of service or repair required.
c. Model No.
d. Serial No.

Sets must be repackaged in original shipping containers using IFR packing models. If original shipping containers and materials are not available, contact IFR Customer Service Dept. for shipping instructions.

All freight costs on non-warranty shipments are assumed by customer. (See "Warranty Packet" for freight charge policy on warranty claims.)

## D-2 REPACKING PROCEDURE (REFERENCE - FIGURE D-1)

1. Make sure bottom packing mold is seated on floor of shipping container.

2. Carefully wrap test set with polyethylene sheeting to protect finish.

3. Place test set into shipping container, making sure set is securely seated in bottom packing mold.

4. Place top packing mold over top of set and press down until mold rests solidly on bottom packing mold.

5. Close shipping container lids and seal with shipping tape or an industrial stapler. Tie all sides of container with break-resistant rope, twine or equivalent.

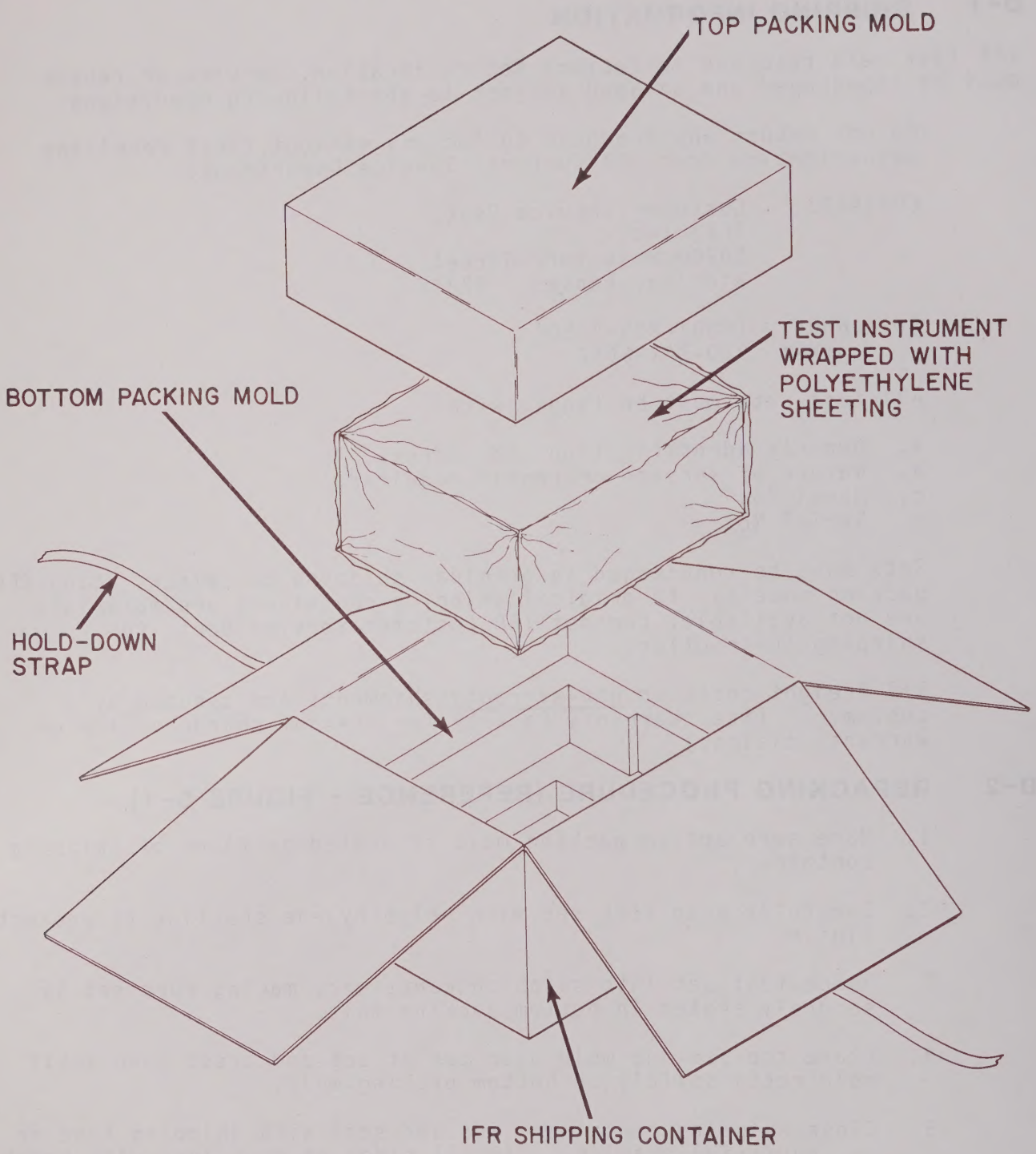



Figure D-1 Repacking For Shipment